MANUFACTURE OF INKS

With tried Recipes and practical hints
with details of every process simply
explained and the secrets of
the art fully exposed

By A Specialist

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CHAPTER I

INK PREPARATIONS.

INK is an ancient invention and the pages of history bear testimony to its extreme antiquity. Manufacture of ink must have synchronised with the attempt of man to record his thoughts, and we are told that as early as 2,500 B C the Egyptians used a kind of ink to write on papyrus In China, ink was used at an even earlier period It was used by the Greeks and Romans and its introduction in India also dates back to a remote period

We have no records which tell us how the ancients made their writing fluids But we know that some of these were permanent as these are still visible in manuscripts preserved in the libraries and the museums The ancient ink preparations are decidedly more permanent than the ink, now commonly in use, which fades away with time It seems that specially in the East the manufacture of ink for the writing of important documents and manuscripts attained a high standard of excellence But it was however reserved for the West—with the invention of and perfection in the art of paper making—to develop the ink industry in all its aspects

GROWTH OF INK INDUSTRY.

The earliest ink seems to be a vegetable varnish which in course of time was replaced by writing inks made from lampblack, soot, or ivory black, in conjunction with other substances like gum, etc. The basis of the black ink used on papyrus by the ancient scribes was decidedly carbon or a carbonaceous compound in a finely divided state for its pigment. In the West for many centuries cuttle fish furnished the principal source of supply of ink manufacture while in India the charcoal of burnt vegetables like almonds, rice, etc., provided inks for writing. But early in the present era these carbon inks completely gave way to iron-gall inks, evidently because of the brilliancy of the black deposit they leave and their more fluid character. With the progress of chemistry, the science of ink manufacture has been studied threadbare and the invention of coal-tar dyes has lent a new colour to the ink industry. These dyes are employed in the manufacture of inks of all sorts but the importance of iron-gall inks remains unsullied on account of the brilliancy of colour and the permanence of shade. At the present day, however, the manufacture of inks of all shades of tints and for all purposes has been brought to more exactitude than ever, and chemists and manufacturers are still working in unison to find out the ideal conditions for the best and safest ink.

TYPES OF INKS.

The subject of ink encompasses a wide range of articles These, in general, may be classified into plain writing fluids, copying fluids, marking inks, stamping inks, sympathetic inks, type-writer inks, printing inks, etc, etc The diversity will be made home to a greater degree when a consideration is made of the fact that each of these particular inks may be prepared in different shades of colours, such as, blue black, black, blue, red, green, violet, etc, etc.

WRITING INKS.

Writing Inks are fluid substances containing colouring matter in solution or suspension, or both, for making a permanent writing on paper. There are also such kinds of inks as ink powders, ink tablets, ink sticks, ink papers, etc which may be classed as inks, for, though not in the fluid state, these ultimately give rise to fluid ink when dissolved in ordinary or hot water.

Mention may here be made that the writing inks may be prepared in various colours But looking to the permanency and elegancy and also the facility of getting the colour, black or rather the blue black stands foremost of all, the other coloured inks being inks of fashion and used for special purposes only as stated under Coloured Inks

COLOURED INKS.

Coloured Inks are however in very great demand and serve the purpose of an additional writing to or corrections in the original writing made in black ink. Red inks in particular are generally employed for making corrections, for marking passages and putting down headlines. Besides, these find favour for ruling purposes in book keeping. Among the rest, violet and green are the most in use, being specially adapted to endorsing signature in commercial correspondence. The blue inks are now met with in the market, specially in the tablet form, but are rarely used except by school boys for writing where permanence is of no importance.

The chief drawback which works against the greater employment of coloured inks as vehicles of writing in spite of their cheapness is that they can hardly compete with the black or blue black inks in durability. The coloured inks fade away in a short time, and this is why papers that are important and are required to stand a number of years are written with black ink only.

COPYING FLUIDS.

Copying Fluids are ordinary writing inks capable of giving more than one copy from the original writing. These fluids are in good demand by commercial houses where copies of the original writing are required for filing,

circularising and for other purposes. In most offices, the copying press is a necessary accessory but this is used when only a few copies are wanted. In cases when a large number of copies is needed, duplicators or hectographs are generally called into requisition The preparation of copying fluids varies according to the number of copies required and the mode of copying, and both the copying inks for copy presses and hectograph inks find ready sale in the market.

MARKING INKS.

Marking Inks are used when delible or indelible marks or designs are to be produced on cloth, piece-goods, glass, wood, etc They usually contain some colour dissolved in gum solution but when permanency of effect is desired great care is taken in their preparation.

STAMPING INKS.

Stamping Inks are inks for metal or rubber stamps and as such are in high demand in commercial quarters.

STENCIL INKS.

Stencil Inks are used for production of any writing design on wall, wood, boxes, packages, etc. These are required in marking packages and for purposes of wall advertisement.

SYMPATHETIC INKS.

Sympathetic Inks are rarely used as inks. They are inks for secret correspondence and play-things for magicians to learn. They are invisible until heat or some other power is employed to develop them. For example, a dilute solution of chloride of copper, used in writing, is invisible until the paper is heated, when the letters are seen of a beautiful yellow, disappearing with the heat that develloped them. The addition of a salt of nickel renders them green.

INDIAN INK.

Indian Ink consists of solid cakes made of lampblack and size or animal glue. It is used for designs in black and white in which it possesses the advantage of being able to afford gradations of tones according to the dilution with water.

PRINTING INK.

Printing Ink, as its name signifies, is used for printing on paper and is now one of the most important paraphernalia of modern civilization. As a general rule it should distribute freely and easily and work sharp and clean; should dry up quickly; should not be too much tenacious for the type; and should be able to withstand all the effects of time and chemical reagents. It essentially consists of a mixture of lampblack, finely divided carbon

and oil It thus forms a class by itself and the process of manufacture is elaborate and complicated Though more of the nature of a varnish or paint than of an ink, the increasing demand for this variety of ink in the country demands attention from enterpreneurs and therefore it will not be out of place here to devote a separate chapter to this subject

MISCELLANEOUS INKS

Among other important types of inks mention may be made of lithographic ink autographic ink, ink for writing on glass, ink for typewriter ribbons, drawing ink ruling ink, vanadium ink, etc , etc

CHAPTER II.

CLASSIFICATION OF WRITING INKS.

WRITING inks are fluid substances containing matter in suspension or solution, or, as commonly is the case, these comprise of finely divided insoluble precipitation suspended in water.

The writing fluids of the present time require complicated processes for their manufacture and these again differ widely from one another. The processes are mainly based on empirical results, and the recommendations of the chemists who have investigated into the subject are often at great variance.

THREE CLASSES OF INKS.

But considered from all points of view, the most important of these inks may be divided into three general classes:

1. Logwood Inks.
2. Aniline Inks.
3. Iron-gall Inks.

The last named variety may again be classified under the following heads:

(a) Gallo-tannic Inks.
(b) Gallic Acid Inks.
(c) Alizarine Inks.
(d) Oxidised Inks.

LOGWOOD INKS

Logwood Inks have logwood as their basis The chips of logwood are put into vats with other necessary ingredients and go through a process much resembling the steeping of tea in order to extract the colouring matter Logwood extract which occurs in the form of irregular pieces or flat plates with a shining darkbrown surface is highly soluble in water and yields a good ink of fine colour Logwood chips are rarely used alone in making inks Its colour undergoes modification according to the nature of the substance with which it enters into combination For example with ammonia a violet ink is obtained with alum or lead acetate and ammonia a blue colour is secured with gallnuts the ink writes a purplish black and dries black while with neutral potassium chromate a clear black ink is available Logwood inks are in general use in schools and for other purposes where absolute permanency is not required

ANILINE INKS

Aniline inks which form the second item under classification of inks are made by dissolving aniline colours in water Aniline dyes derived from coal tar are obtained in various shades and give rise to various coloured inks which are now a days almost exclusively made from these substances on account of their ready supply in the market and great cheap

ness. To-day inks such as red, blue, green, violet all have as basis aniline dyes.

But mention may be made here that all dyes are not equally fitted to be made into inks. Those which are most easily soluble in water should only be employed. Nothing beyond water is required to convert the dye into ink. The chief desideratum of the aniline inks is their fluid character which eminently fits them for use in stylographic pens. Moreover, on account of their extreme solubility the inks do not show any existence of suspended matter in their body. But the principal drawback of the aniline inks is their extreme fugitiveness, that is to say, the colour fades away on exposure to air for some time. This drawback has now been remedied and colours which give comparatively fixed inks have been found. Another privilege of this type of inks is that they require no addition of gum, sugar or dextrine to have the ink clear.

IRON-GALL INKS.

The third and the most important class of ink is known as iron-gall inks. The preparation of these inks has as its basis the chemical combination of iron, tannin and oxygen of the air.

The most important factor in the making of this ink is gallnuts which on extraction yield an astringent principle called tannin. As the name implies, the iron-gall inks are made

by the combination of an iron salt, generally the ferrous sulphate, with the tannin extracted from gallnuts While there are other ingredients added, these two are the most important in the making up of this type of ink

The iron-gall inks as already referred to may further be subdivided into the following groups —

1 Gallo tannic Inks
2 Gallic Acid Inks
3 Alizarine Inks
4 Oxidised Inks

We deal with each of these types of inks one by one

GALLO TANNIC INKS

Gallo tannic inks are produced when the astringent principle of any tannin bearing substance such as gallnuts, myrobalans etc , is extracted in the form of gallo tannic acid without allowing these to ferment in the least But when the gallnuts, or other tannin materials are allowed to ferment the gallo tannic acid is further converted to simple gallic acid and the ink produced therefore is known as gallic acid inks

The gallo tannic ink is practically colourless until acted upon by the oxygen in the air, that is, a pen dipped into such fluid would make no visible mark on the paper but this will change as the ink dries up into an intense black

Most people, however, like to see what they are writing as they write and hence the gallo-tannic acids are kept exposed for some time to the action of air so that the ink is partially oxidised and is of sufficient immediate blackness to be legible. But inks prepared in this manner have the special drawback that being partially oxidised they do not act with former vigour on cellulose and thus do not penetrate sufficiently into the fibres of the paper and are liable to a great extent to be washed away. To remedy against this, indigo or a blue aniline colour is added to the ink to form a provisional colour to be discernible on writing. But as the ink is exposed to the air, the iron-gall compound develops to an intensely black and permanent colour, entirely superseding the original blue which ultimately fades away. This change in colour is what causes it to be referred to commonly as blue black ink. The black remains clear and legible as long as the paper on which it is written lasts. The addition of indigo is specially recommended as this enhances materially the permanence of the ink and renders it immune from the actions of bleaching agents.

It may be mentioned here that the addition of Prussian blue, Turnbull's blue, ultramarine, etc., to the gallo-tannic inks is prohibited as these are neither readily soluble nor chemically inactive towards the tannin in the ink.

LOGWOOD-TANNIN INKS.

The paleness of writing with gallo-tannic inks can also be obviated by the addition of logwood extract to the ink. The special characteristic of such logwood tannin inks is their splendid blue black colour and great freedom of flow. Moreover, they do not corrode the nibs as fast as the simple gallo-tannic inks, as the logwood probably forms a varnish on the pen when it is laid aside. This is believed to exclude the air, which prevents rust.

GALLIC ACID INKS.

Gallic acid inks are prepared by letting the gallnuts to ferment before the addition of other ingredients containing iron salts Like gallo-tannic inks they give a fine blue black writing and over and above that they are far less liable to decomposition than the gallo-tannic inks. The writing is brilliant and the ink remains free from scums which are liable to be formed in case the gallnuts are not allowed to be fully fermented For this reason addition of preservative agents like creosote, carbolic acid, etc, is not needed in the case of the gallic acid inks

ALIZARINE INKS.

Alizarine inks met with in the market belie their name. They are not at the present time really made from the alizarine colour

given by madder, as they were wont to be formerly. Now ink preparations of fine colour, very fluid, and without suspended precipitates, are termed alizarine inks. They are mostly gallic acid inks but to obviate the formation of any suspended black precipitate in the body of the ink, which finally causes formation of sediments, acetic acid in proper quantity is used. Thus the precipitation of the tannate of iron in the ink is prevented. Sometimes sulphuric acid is used for the same purpose. These inks do not form any precipitate even when they stand for years in bottles. The solution has generally a rather pale greenish or brownish colour and the writing is at first green, turning in a few hours to fine black. The colour however being pale at the time of writing, suitable colours or indigo carmine are added to the ink.

OXIDISED INKS.

Lastly we have the oxidised inks where all the ferrous salts in the ink have been oxidised to the ferric state. These inks are liable to yield copious precipitate and a large quantity of gum is added to keep this in suspension. The chief drawback of the ink is that the oxidation of the ink does not take place in the fibres of the paper, which is an essential factor to render the ink permanent. The excess of the gum present in the ink

causes glossy appearance and stickiness These inks are also liable to yield large deposits with the result that the pen is clogged very often The use of these inks is now restricted Japan ink is an instance in view

Hence in the preparation of inks oxidisation of ferrous salts to the ferric state should be avoided with care, for when once this happens the quality of the ink can hardly be improved Use of partly oxidised ferrous salt must also be brought under restriction for the purpose

CHARACTERISTICS OF GOOD INK

Before closing this chapter, we may touch upon the essential properties which all good inks must possess In manufacturing inks special attention should be paid that these standard characteristics are attained so far as it is practicable The following are the chief of them

(1) The ink should have the properties of flowing freely from the pen and making a legible and permanent record immediately on writing If it is thick and does not flow easily, it is difficult to execute finest lines and character with it

(2) The ink allowed to stand at rest in a white glass vessel freely exposed in diffused day light protected against the entrance of dust must remain free from deposit upon the surface of the ink or on the bottom or sides of

the vessel. Formation of scums and deposit of sediments are to be strictly guarded against.

(3) The ink should contain no less iron than necessary so that the ink may penetrate deep into the fibres of the paper and the colour may not fade or decay with age.

(4) The ink must give as quickly as possible after exposure to diffused day light an intense colour and the marks must equally resist changes from light, air, water or alcohol.

(5) The ink must be fluid and should not get clotty. This should flow readily and uniformly and strike no more than through the paper nor remain sticky immediately after drying.

(6) The inks should not corrode the pens and should be readily soaked in by the blotting paper. This should not attack the paper.

(7) The ink should keep its colour unchanged for a long time, even if the paper gets damp or wet.

(8) The ink should not spread on the surface of the paper written on.

Again, the proportion of tannin present in the various tannin-bearing substances varies greatly. While commercial gall-tannic acid contains 86 per cent. pure tannic acid, Alleppo galls contain 62 per cent., Chinese galls 75 per cent., dividivi 40 per cent. and myrobalans 30 per cent.

GALLNUT.

Any substance containing "iron-blueing" tannin can be used in making inks but the chief of these is the gallnut, certain species of which are found in China, India, Japan and even in some oak and willow trees in America. A peculiar kind of insects bores into the small twigs of oak trees and then lays eggs in the wound. A little lump is the result. The egg grows with the gall and is soon converted into a larva. Eventually the larva becomes a fly and escapes by eating its way out. The best nuts for ink making are those that are picked when fully ripe but just before the escape of the insect, as such nuts only contain the largest amount of tannin.

Gallnuts are produced in India but the best varieties are received from Aleppo and go by the name of Aleppo galls. In selecting gallnuts for the making of ink, care should be taken that these are whole, weighty and unperforated, for such galls only contain the largest amount of tannin.

The gallnuts are first bruised and sometimes converted into coarse powder and boiled with water: or, what is better these are digested for several hours in water of a temperature near the boiling point The decoction is then filtered and used in the making of ink

OTHER TANNIN SUBSTANCES.

Besides gallnuts, tannin is afforded by the three varieties of myrobalans—belleric, chebulic and embellic These are to be found in large quantity in India, and therefore greater attention should be paid to the manufacture of inks from these myrobalans

Another tannin substance made use of in the ink industry is catechu It is employed to some extent in foreign countries also It is meet and proper that catechu being an indigenous substance is more and more utilised as an ingredient for ink, specially because it improves the colour of the ink Other tannin substances for ink making, but rarely used in India, are extracts from the wood or bark of chestnut trees, sumach, dividivi, etc , etc

LOGWOOD.

Logwood, viewed from another point of view, is an important ingredient entering into the composition of ink It is not an indigenous substance This comes from the forests of Central America and the West Indies. The logwood trees furnish a dark brown coloured

wood which is cut into chips and put into vats to extract the colouring matter. This with galls yields black colour but violet and red inks may also be obtained from it by treating it with suitable mordants. For example, sulphate and acetate of copper impart to logwood a blue shade while stannous chloride yields a violet shade. The extract of logwood which is available in the market in solid condition is usually used in ink making instead of starting with the chips.

IRON SALTS.

The next important thing in the manufacture of ink is the iron salt. It has been experimentally found that quite a large number of iron salts may be used for the purpose but ferrous sulphate has been regarded as practically the most suitable in ink manufacture. This is otherwise known as copperas or green vitriol. Lately attempts have been made to substitute the ferric chloride but its use is rather restricted.

SUGAR.

Sugar is sometimes added to increase the flowing property and lustre of the ink but this makes the ink dry more slowly which fits it eminently for copying inks. This also favours the growth of mould and tends to render the ink stringy so that long threads spin from the nibs.

DEXTRINE

Dextrine holds the colouring matter in suspension by increasing the density of the ink and may be used in place of gum arabic but being hygroscopic the ink dries slowly on the paper Dextrine is however largely used in the manufacture of ink tablets and serves as a binding agent for the colouring matter

SOLUBLE STARCH

Soluble starch is another ingredient which is used in the making of ink powders It differs from ordinary starch which is to be specially treated for the purpose

Soluble starch is obtained by boiling starch with water and the solution is then rendered quite clear by the addition of a little caustic soda or potash Starch may also be made soluble by stirring starch powder with a solution of caustic soda, or by stirring with water and warming with malt dilute sulphuric acid or bleaching powder According to a German patent soluble starch is made by mixing 100 parts by weight of starch flour with 3 5 parts of ammonium persulphate and 150 parts of cold water, allowing to stand for 10 hours, filtering and washing until free from persulphate and drying Boiling with volatile organic acids such as formic or acetic acid also renders starch soluble heating powdered starch to 62° 63°C with hydrochloric acid vapour also renders it soluble

GUM ARABIC.

Most of the inks contains gum as a necessary ingredient. The reason is this. The colour of the ink is due to the presence of finely divided iron salt which should remain in suspension in the fluid. Gum arabic fulfils this object and a proportion of gum is added in all good inks for the purpose of suspending any precipitate that may be produced in the body of the ink on exposure to air equally through the solution and preventing its deposit. Besides, gum is a necessary adjunct in the making of all copying inks, for it not only attaches the colouring matter in the ink to the surface of the paper but also protects the ink from too rapid drying. Gum also shields the writing from the action of the air and tends to preserve the colour but added in excess it hampers free flow and causes the ink to flow only languidly.

PRESERVATIVE AGENTS.

Inks are liable to mould and to obviate this it is usual to add creosote, phenol, carbolic acid, acetic acid, alcohol, corrosive sublimate, arsenic, oil of cloves, bergamot or any other ethereal oil. To preserve the ink salicylic acid is the most used. Alum and boric acid are also employed for the purpose. Some of the large makers however allow the ink to become covered with a skin of mould in cask in order to render it less liable to undergo the

same change when subsequently bottled and sent to the market for sale

To prevent the deposition of precipitate in the ink, various acids such as hydrochloric acid, sulphuric acid acetic acid etc, are used

INGREDIENTS FOR COLOURED INKS

A wide range of colours enters into the composition of inks Substances of widely varying nature are employed in the manufac ture of coloured inks Some of these are of vegetable origin such as brazil wood, maddar, lodhwood, indigo, etc , some of them are of mineral origin such as verdigris, prussian blue, malachite, etc , while some others are of animal origin such as cochineal These were much in vogue in olden days but with the in vention of coal tar dyes which are easy to handle, the old colours have fallen into ill repute and are now rather restricted in use

Chips of Brazil wood commonly known as *bakam kastha* when dipped in water yield a fine red dye which can be intensified by the addition of alkalies The dye property of lodh wood resides in the thick, corky, grey bark which yields a good yellow The colour however is modified to various shades by the incorporation of other dyes Indigo and more generally indigo carmine are used by ink manufacturers to produce blue or blue black inks and to lend a provisional colouring to blue black inks Ordinary indigo obtained

from *indigofera tinctoria* is almost insoluble in water and hence it is to be specially treated to render it soluble. Indigo carmine is most suited for the purpose. Cochineal again yields a red dye and is obtained from the dried bodies of the female insects Coccus Cacti.

INDIGO CARMINE.

The special method of treating indigo to convert it into sulpho-indigotic acid, or indigo carmine as it is popularly known, may be found useful.

The indigo is powdered finely and dried at a temperature lower than 120°C. It is put in a spacious earthen basin and fuming or Nordhausen sulphuric acid is poured slowly with constant stirring while it is still warm. Acid four times the weight of dried indigo being added, the basin is left covered up for twenty four hours. Sulpho-indigotic acid is hereby formed. The liquid is then diluted to 10 or 12 times its old volume and is allowed to stand for a few days. Insoluble matters settle below and the clear solution is decanted off. It is then treated with potassium carbonate. Carbon dioxide escapes due to the presence of excess of acid in the solution. When no more carbon dioxide evolves, which is indicated by the ceasing of the effervescence, the solution is concentrated and preserved in bottles. The carmine thus formed is deep blue in colour and extremely soluble in water

but almost insoluble in alcohol or in saline solutions

SYNTHETIC DYES

These organic colouring ingredients have now-a days been replaced by synthetic dyes on account of their cheapness and brilliancy of inks produced A list of the synthetic colours most suited for writing inks follows These, it need not be mentioned, must be water soluble

Black—Nigrosin, Aniline Black

Red—Eosine, Erythrosine, Phloxine, Ponceau Scarlet, Cotton Scarlet and Scarlet

Green—Neptune Green S G, Light Green S F (Yellowish), Light Green S F (Bluish), Diamond Green G & B

Blue—Methylene Blue, Acid Blue, Pure Blue, and Soluble Blue T

Violet—Acid Violet 4 B L Methyl Violet

Yellow—Fast Yellow, Tartrazine

OTHER INGREDIENTS.

Inks which are intended to dry immediately after writing contain as an essential ingredient a considerable proportion of a volatile liquid, such as spirit or alcohol

Vinegar is used by ink manufacturers in dissolving the precipitate which may be separated out This also removes the oiliness in inks

Besides these there are many other substances which go to make inks such as cream of tartar, glycerine, alum, borax, potassium bichromate, ammonia, tartaric acid, acetic acid, etc. Shellac, oleic acid, castor oil, etc., are used in making stamping inks.

Again various articles are required for the manufacture of printing inks. The important classes of chemicals mostly used in this line are pigments like lamp-black, ultramarine, vermilion, chrome red, Prussian blue, Paris blue, etc., etc.; driers like magnesia, vehicles like linseed oil.

CHAPTER IV

MANUFACTURE OF WRITING INKS.

NEED FOR CAREFUL MANIPULATIONS

ALTHOUGH there is perhaps no other chemical preparation in such general use as writing ink, few inks answer all the requirements of good inks This may be explained by the circumstance that receipts for ink can not be calculated according to a chemical formula but largely depend on experiments—specially because the raw ingredients used may differ in quality from season to season and their ink-bearing contents may also exceed or fall below the average strength as computed in the recipes Hence success in ink manufacture would greatly depend upon manipulations, and experiments and often modifications of the receipts may be necessary without essentially altering the underlying principle of manufacture

ESSENTIALS OF GOOD INKS

While manufacturing ink particular attention should be paid that the manufactured ink flows readily from the pen, does not attack the pen, nor does it throw sediment after bottling The colour should be deep and durable Some of the inks are observed to turn pale and depo

sit a black sediment. This is mainly due to the fact that the fluid is not dense enough to keep in suspension the tannate of iron which is formed during ink manufacture. The specific gravity of inks should not generally exceed 1.04. For other characteristics see p. 15.

TANNIN INKS.

The nature and constitution of tannin inks have been discussed in *Chapter II.* We now proceed to mention the precautions necessary in manufacturing these inks.

The greatest drawbacks from which tannin inks suffer are that they flow rather thickly and are liable to mould. The tannate of iron is formed as a result of reaction between the extract of gallnuts and ferrous sulphate. The tannate is often likely to separate out from the ink and settle below. The ink thereby loses its colour and becomes useless. To avoid this a quantity of gum arabic is used in all tannin inks. This increases the specific gravity of the ink and holds the tannate in suspension.

The mould which appears on all tannin inks is hard to eliminate. A trace of the fungi causing the mould present in the ink will lead to further moulding. An easy method of averting this is to filter the ink first in order to free it from the mould and then to boil it to kill the spores. Boiling water may on the alternative be poured on it. The ink

The great point to know in making these inks is to hit at the exact proportion of the gallnuts and the ferrous sulphate to be added. If the ferrous sulphate is in excess, the characters written will turn yellow while equal weights of galls and ferrous sulphate will give a black ink but the writings soon turn brown and rusty. Hence the quantity of ferrous sulphate added should be much less than the weight of the galls In this case the ink will flow readily and will at the same time remain black for a long time. But the calculation of the exact proportion for complete reaction being impossible, the tannin is taken rather in excess. Any excess of organic matter also makes the ink liable to mould, even after it has dried on paper and the colour fades and hence some preservative agent such as carbolic

acid or acetic or salicylic acid is put in to prevent moulding.

The gallnuts are sometimes baked over fire before being soaked in water for decoction. This gives an ink which writes black at once but in such cases care should be taken to see that the nuts are not overheated and do not volatilise out. The ink in this case is not oxidised on the paper and therefore does not penetrate it.

The ferrous sulphate also is sometimes roasted over fire in iron or earthen pans. This first falls into powder and then turns yellow. But if heated too much, the sulphate is converted into insoluble basic sulphate which runs to waste. A simple method of oxidising the ferrous sulphate follows: Mix two parts of water with one of concentrated sulphuric acid and pour the mixture over twenty parts of ferrous sulphate. The whole is then slowly heated to the temperature of 334°C. All excess of sulphuric acid must be expelled from the mass, otherwise the acid will corrode the nib.

LOGWOOD TANNIN INKS.

We already know what are the logwood tannin inks and their principal constituents. The general method of manufacture follows.

In making logwood tannin inks logwood is used along with gallnuts. The logwood is first made into chips and the raspings are then

boiled in water. The logwood extract is thus obtained. The gallnut extract is made separately and mixed with the logwood extract. If logwood extract as available in the market is used, first dissolve it in the least possible quantity of hot water and then add to it the solution of the other ingredients separately made.

It is however a good plan to put the solid ingredients into a bag, which is hung two-thirds immersed, in water In this case the ink does not require filtering It is usual to add a quantity of vinegar in making logwood-tannin inks but in all cases a little crude pyroligneous acid (which contains carbolic acid) is to be added to prevent moulding

ALIZARINE INKS

The alizarine inks are a misnomer They are simply iron inks in which precipitation of tannate of iron is prevented by acidification with acetic acid or with sulphuric acid In fact they do not contain alizarine or any constituent of madder. The ink looks a rather pale greenish or brownish in colour; the letters at first appear green but turn in a few hours to a fine black as the acetic acid present in the ink evaporates away and a black precipitate is thrown on the paper.

The final product in the case of alizarine inks should contain free acid in slight excess This will not much corrode the nib as the ink

dried on the nib will form a protective coating which prevents further action. If the free acid is much in excess, it must be cautiously neutralised by the addition of ammonia but any excess of it is to be avoided; or, the acid in the ink will be converted into salt with the separation of the tannate of iron.

The alizarine inks generally write very pale; this can be avoided by adding indigo carmine or aniline dyes, the colour of which is finally concealed when the ink turns black.

PRESERVATION OF INKS.

Great care need be exercised for the preservation of ink and prevent mouldiness. Excess of ferrous sulphate in the ink possesses preservative action to some extent but then the characters executed with the ink get brown and a sediment is liable to be formed below. Alum is an efficient preservative of mould but this corrodes the steel nibs and often precipitates the colours, thus making the ink pale and useless. Carbolic acid also prevents mouldiness and should be preferred to pyroligneous acid which also contains carbolic acid to some degree. Carbolic acid has been found a very effectual disinfectant and preserves 1,000 times its own volume of ink. It however suffers from a penetrating smell, for which reasons this is replaced by salicylic acid which is perfectly odourless. It has been found that salicylic acid preserves 5,000 to 10,000 times

its weight of ink and prevents moulding once for all It is also possible to preserve ink with boric acid This can preserve 1,000 times its weight of ink Corrosive sublimate is another preservative but it is rarely used in ink on account of its highly poisonous nature and high cost Oil of cloves and some ethereal oils possess preservative properties and are made use of in making inks But these being of volatile nature, the ink gets mouldy when left exposed to air for some days Some mineral acids like hydrochloric acid, sulphuric acid and acetic acid are also preservative agents in so far as they dissolve the precipitate which may be formed when the ink comes in contact with air The most used of the preservative agents are of course salicylic acid, boric acid and carbolic acid

MANIPULATIONS.

A few observations of a general character on ink making should be found useful

Whenever gallnuts are used to prepare inks, the first thing to be done is to bruise them thoroughly When logwood or catechu is used, it should be cut into chips or small pieces If myrobalans are to be used, they should be crushed and unseeded They are steeped in vats specially provided for the purpose Iron vats and cauldrons may be used for the occasion They are covered over with water and allowed to digest for several days for the ex-

traction of the tannin. Sometimes the whole is brought to a boil to expedite the reaction. As presence of woody fibres of the galls in inks is undesirable, the fibrous materials are placed in a bag which is then hung in water with two-thirds or whole of its bulk immersed. Sometimes boiling of the galls is also recommended with several lots of water for complete extraction. When gallic acid *inks are to be prepared, the galls are left alone* to ferment in a moist condition. Moulds form on the surface, and sometimes it is a good plan to inoculate the mass with the mould from a piece of a mouldy bread or leather. The conversion into gallic acid is completed in 8 to 10 days. To prevent further action boiling water is then poured over the mass to kill the ferment. The solution of gallic acid can then be drawn off by a cock.

The ferrous sulphate should be powdered before addition and if possible dissolved in a separate lot of water. See that the sulphate is not oxidised or even partially oxidised, which will mar the ink. The gum arabic may be similarly dissolved in another lot of water before addition to ink but this is unnecessary when it is mixed into boiling liquor.

BLUE BLACK INK.

I

Myrobalans	8	ch.
Belleric Myrobalans	8	„

Embellic Myrobalans	8	ch
Small Tauri	1	sr
Iron Rust	8	ch
Water	16	srs
Gallnuts	1	sr.
Ferrous Sulphate	8	ch
Pure Blue	3	oz.

PROCEDURE.—Crushed and unseeded myrobalans, 8 ch in weight, of each variety, are taken These, with small tauri and iron rust, are boiled in 16 seers of water in an iron cauldron After half an hour remove from fire and strain when cold To the extract then add the gallnuts, all previously bruised and made into small pieces After 3 days again boil the whole When boiling takes place, stir in the powdered ferrous sulphate and continue heating When 10 seers of the extract is left, remove the pan from fire and strain when cold and leave aside for 15 or 16 days Then strain again and introduce the pure blue tied in a piece of cotton cloth The colour will begin to dissolve out After 2 days most of the colour will be dissolved If any thing is left within the cotton cloth, press out by squeezing Then strain and pack air-tight Use preservatives as directed on *pages* 28 and 32

II

Gallnuts	3	srs
Ferrous Sulphate	1	sr.

Black Catechu	2	ch.
Water	30	srs.
Acid Blue	1	dr.

PROCEDURE:—The gallnuts are first of all bruised and made into medium pieces. These are then steeped in 30 seers of water in an iron cauldron and set aside for a week. After the period put the pan on fire and allow the mass to boil for some time. A black colour will then develop. Boiling should be continued till a pen can write black letters. Not more than half an hour's boiling will be needed for this purpose. Then add to this the ferrous sulphate in the powdered condition. Continue boiling and after one quarter of an hour throw in the powdered catechu. Boiling is further continued and when good black colour is obtained by writing with pens, the pan is removed from fire. Generally not more than one hour's boiling will be required for the purpose. The pan is then left undisturbed for a fortnight when a crust will form on the surface. Remove the crust and strain through a cloth. Finally add 1 dr. of acid blue and again allow the extract to remain quiet for 3 days. Finally strain, pack air-tight and seal the mouth with pitch. Use preservatives, if necessary, as directed on *pages* 28 and 32.

III.

Myrobalans	2½	srs.
Belleric Myrobalans	2½	,,
Embellic Myrobalans	2½	,,

Acacia Bark	2½ srs
Water	20 ,,
Ferrous Sulphate	1¼ ,,
Gum Arabic	1¼ ,,
Acid Blue	8 oz

PROCEDURE —Take 2½ seers of each of three kinds of myrobalans, all previously unseeded, and bruise them well The bark of acacia should also be cut into small pieces These four ingredients are then dropped together in 20 seers of boiling water in an iron cauldron and the whole is set aside for a month Then introduce into this ferrous sulphate in powdery form and again allow to stand for 4 or 5 days Then add the powdered gum arabic and stir well, and leave the whole undisturbed for 15 days again A crust will be formed on the surface by this time Take this off and mix the acid blue and after 3 days strain through a cloth and bottle air-tight For preservatives refer to *pages* 28 and 32

IV

Myrobalans	1 sr
Belleric Myrobalans	1 ,,
Embellic Myrobalans	1 ,,
Small Tauri	1 ,,
Gallnuts	1 ,,
Water	15 srs
Ferrous Sulphate	1 sr
Acid Blue	4 oz
Creosote	q s

PROCEDURE:—Take 1 seer of each of the three varieties of myrobalans, previously unseeded. These are, along with gallnuts, bruised and are allowed to remain steeped in water for 7 days in an iron pan. After the period the pan is put on fire and the whole is brought to a boil to bring out a black colour. The liquid should be tested from time to time to note if the colour is developed or not. When a black colour appears—half an hour's boiling will be sufficient for the purpose—add the powdered ferrous sulphate and go on boiling. After half an hour remove the pan from fire and set aside for 15 days. Then strain through cloth and add the dye and stir well. After 24 hours strain again and put into bottles. For prevention of moulds add to every bottle 7 drops of creosote and seal the mouth with pitch.

V.

Acid Blue	1 oz.
Gum Arabic	4 dr.
Water	2 srs.

PROCEDURE:—Allow the powdered gum arabic to soak in water for a day and introduced into this the blue dye well tied in a piece of cotton cloth to make almost a spherical bag. Move this about so that the colour may begin to be dissolved. When the colour has fully dissolved, take out the cloth. Allow the liquid colour to remain undisturbed for 24 hours. Then strain and bottle. This ink will not deposit sediments.

VI.

Alleppo Gallnuts (coarsely powdered)	1	lb
Sulphate of Iron	5	oz
Gum Arabic	[illegible]	
Boric Acid	1	"
Extract of Indigo	1	"
Picric Acid	1	dr
Water sufficient to make	1	gallon

PROCEDURE:—Macerate the gallnuts in 1 gallon of water for twelve hours, then boil in a kettle for one hour and pour off the decoction, add half a gallon of fresh water to the dregs, and boil again for half an hour and pour off the liquid, press the residue and mix the product with the previous decoction This will make about 1 gallon of the liquid, to this, while still warm, add the remaining ingredients and dissolve; add water if necessary to make one gallon, and after standing for 12 hours, or more, strain through a coarse muslin strainer This makes a good writing fluid, similar to those most popular in the market Carbolic acid need not be added in this case

VII.

The following formula is said to have the same composition as the celebrated Stephen's ink—

Powdered Galls	15	parts
Sulphate of Iron	5	"
Iron Filings	4	"

Indigo	½	part.
Sulphuric Acid (concentrated)	3	parts.
Water	200	"

PROCEDURE:—Boil the galls with the water for about an hour, strain and then add sulphate of iron to the liquor. Then add the solution of indigo in sulphuric acid and lastly, add the iron filings so as to neutralise the excess of acid. After a week or more strain and bottle. This ink writes green, but turns black after a few hours. It flows very freely from the pen.

VIII (ALIZARINE INK).

Gallnuts	1½	lbs.
Indigo	4	oz.
Sulphuric Acid	8	"
Iron Filings	7¾	"
Chalk	5	"
Water	q. s.	

PROCEDURE:—Extract 1½ pounds of bruised gallnuts with 3 quarts of water. On the other hand pour 8 ounces of sulphuric acid over 4 ounces of powdered indigo, and let it stand for 24 hours. Then dilute the blue fluid with 3 quarts of water, and add to it 7¾ ounces of iron filings free from rust and 5 ounces of pulverized chalk. After the fluid has stood for some time it is filtered and the filtrate added to the decoction of gallnuts, also previously filtered. The writing executed

with this ink is first greenish, but soon assumes a blue black colour

IX

Black Ink	10 srs.
Pure Blue	2½ srs

PROCEDURE —Blue black ink can be prepared from ordinary black ink in the following manner which is of much interest to the manufacturers The black ink is first of all strained through a piece of cloth, made three or four fold To this then add the blue colour and stir well Strain again and bottle The proportion of ink and colour may be changed as desired according to popular taste

X

Chinese Galls	200 parts
Talc	q s
Ferric Chloride	100 parts
Phenol Blue	q s
Carbolic Acid	q s
Water	q s

PROCEDURE —The Chinese galls are bruised and powdered and are kept moist (but not wet) at 20°C to 25°C until mouldy This generally takes eight to ten days and shows that most of the gallo tannic acid has fermented into gallic acid The galls are thoroughly extracted with hot water, talc is added, the solution filtered, and made up to 1,000 parts by weight Then the ferric chloride solution containing 10 per cent of iron is added and the ink left for two weeks in a closed flask

and then carefully decanted off. To impart a blue black colour dissolve 3 parts of phenol blue in 400 parts of water and add 1 part of carbolic acid. This colour should be added to 600 parts of the ink solution. The whole is then kept for a week in a loosely covered flask and then decanted. After this the ink should be carefully bottled for use.

XI.

Blue Aleppo Galls	2¼ lbs.
Cloves (Pulverised)	1 oz.
Ferrous Sulphate	¾ lbs.
Sulphuric Acid (Dilute)	½ fl. oz.
Acid Blue	q. s.
Water	1 gallon.

PROCEDURE:—Bruise galls and cloves in vessel of 1½ gallons capacity, pour one gallon cold water, stir well and allow to digest with daily stirrings for two weeks. Then filter through paper into clean vessel. Press the remaining marc through cotton cloth and add to filtrate. Now add ferrous sulphate to the liquor, dissolve and filter through paper, adding the acid to the filtrate. Shake, and to every point of this final liquor add 20 grains of the blue dye. Allow to stand and decant from sediment.

XII.

Gallic Acid	2 lbs.
Tannic Acid	¼ ,,
Ferrous Sulphate (Pure)	3 ,,

Aniline Blue	1¾ lbs.
Carbolic Acid (Pure)	½ oz.
Water (Soft)	35 gallons.

Procedure:—Dissolve ferrous sulphate in part of the water, add gallic and tannic acids previously dissolved in remaining part of the water. Then add aniline colour and carbolic acid, mix thoroughly and allow to stand for some days. Decant or filter.

XIII.

Gallnuts	7½ lbs.
Sulphate of Iron	2½ "
Iron Filings	2 "
Chinese Blue	6 oz.
Cloves	5 "
Oxalic Acid	2 "
Water	10 gallons.

Procedure:—Boil galls and cloves in the water for 20 minutes, then pour over the Chinese blue and oxalic acid in a cask, put in the other ingredients and stand for about one mouth. Finally strain and pack.

XIV.

Tannic Acid	1 oz.
Gallic Acid	1½ "
Green Copperas	3½ "
Indigo Paste	6 "
Cotton Blue Aniline	1 dr.
Water	1 gallon.

Procedure:—Dissolve the tannic and gallic acids in a portion of the water by heat-

ing. In another portion of the water dissolve the copperas. The indigo paste and the aniline are dissolved in the remainder of the water and the three solutions mixed together. A few cloves added will prevent mould.

XV.

Gallic Acid	2	oz.
Blue Aniline	1	,,
Nitric Acid	3	drs.
Water	1	gallon.

PROCEDURE:—Bring the water to a boil and dissolve the gallic acid in it. Then add the blue aniline and when the mixture is cold add the nitric acid, stirring well at each addition. This ink darkens slowly and can be bottled at once. The ink never deposits and will not turn brown.

BLACK INKS.

I.

Gallnuts	14	seers.
Logwood	3½	,,
Ferrous Sulphate	3	,,
Gum Arabic	3	,,
Water	116	gals.

PROCEDURE:—The gallnuts and logwood are first of all crushed small separately. Gum arabic and ferrous sulphate are also crushed and powdered separately. Water is next boiled and poured over the powdered nuts and logwood in an iron cauldron. Allow the

powder to soak for 15 days, then stir in the gum arabic and incorporate the whole intimately Next day introduce the powdered ferrous sulphate and set the cauldron aside for 10 days Then strain and bottle air-tight For preservatives see *pages* 28 and 32

II

Gallnuts	1½	srs
Ferrous Sulphate	8	ch
Water	10	srs

PROCEDURE —The gallnuts are first of all well bruised and made into medium pieces These are then kept steeped for 5 days in 10 seers of water in an iron vessel The whole is then brought to a boil and after about half an hour ferrous sulphate is added in powder form Continue boiling for a quarter of an hour more, then remove from fire and allow the whole to digest for 20 days Remove the upper crust with a perforated ladle, then strain through a thick cloth Again keep aside for a week and strain in the above manner when the ink will be ready for bottling For preservatives reference may be made to *pages* 28 and 32

III

Myrobalans	1	sr
Belleric Myrobalans	1	,
Embellic Myrobalans	1	,,
Small Tauri	1	,,
Iron Rust	1	sr

Water	20	srs.
Gallnuts	2	„
Catechu	1½	ch.
Ferrous Sulphate	8	„
Gum Arabic	4	„

PROCEDURE:—The three varieties of myrobalans are first crushed and unseeded and then made into small pieces along with tauri. These are then put in an iron pan together with the rust and covered over with 20 seers of water which is then boiled briskly. When 16 seers of the extract is left, remove the pan from fire, strain when cold and introduce into the extract bruised gallnuts and keep the pan aside for 7 days. After the expiration of the period, bring the whole again to a boil and throw in the powdered catechu and ferrous sulphate. After boiling for 30 minutes introduce the gum arabic. The boiling operation is continued further till about 12 seers of the extract is left. Strain when cold and let the pan stand undisturbed for 20 days. A crust will then be seen to be formed on the surface. Remove this and strain again through a piece of cloth. Again set the extract aside and remove the crust after a number of days. Repeat the process till no more crust settles on the surface of the extract. Finally strain, add preservatives as recommended on *pages* 28 and 32 and pack air-tight.

IV.

Embellic Myrobalans	2½ srs.
Water	16 ,,
Gallnuts	1 sr.
Ferrous Sulphate	8 ch.

PROCEDURE:—Take 2½ seers of crushed myrobalans and drop this in water in an iron vessel. Put this on fire and after about half an hour's boiling strain off the liquid extract and allow the bruised gallnuts to soak into it for 6 or 7 days. Then bring the whole to a boil and after about half an hour throw in the powdered ferrous sulphate. When 8 seers of the extract is left, remove the pan from fire and strain when cool. Then set aside for 15 to 20 days. A thick crust will then be seen forming on the surface. Remove this with a perforated ladle and again leave the mass undisturbed for a day. Next day, remove the crust and repeat the process till no more crust forms on the surface. Finally strain and add preservatives as directed on *pages* 28 and 32.

V.

Myrobalans	1 sr.
Belleric Myrobalans	1 ,,
Embellic Myrobalans	1 ,,
Small Tauri	1 ,,
Water	16 srs.
Gallnuts	1½ ,,
Ferrous Sulphate	12 ch.
Gum Arabic	2 ,,

PROCEDURE:—Take 1 seer of each of the three myrobalans, all previously crushed and unseeded. These are bruised along with tauri and made into small pieces. Water is brought to a boil in an iron pan and into this are introduced the bruised myrobalans and tauri. After boiling for one hour, remove the pan from fire and strain when cool. Then allow the gallnuts, previously bruised and crushed small, to soak into this extract for 4 days and then bring the whole to a boil. When boiling briskly, add the powdered ferrous sulphate and continue heating. When 10 seers of the extract is left, remove from fire, strain on the following day and leave this aside for 8 to 10 days after the addition of the gum arabic. The crust which is formed on the surface is removed and the mass is again set aside for a month. Strain and add preservatives as directed on *pages* 28 and 32.

VI.

Tannic Acid, Dry	23.4	parts.
Gallic Acid, Dry	7.7	,,
Ferrous Sulphate	30.0	,,
Gum	10.0	,,
Hydrochloric Acid (dilute)	25.0	,,
Carbolic Acid	1.0	,,
Water	1000.0	,,

PROCEDURE:—Bring the water to a boil. Dissolve the sulphate of iron and gum in a part of this. Then add the acids and expose the

whole to the sun light for six hours Then make up with boiled and cooled water to 1,000 parts

This ink writes pale, but in a few hours turns into intense black A special property of this ink lies in the fact that dipping in water or wetting the writing increases the blackness, which is indelible

VII

Nigrosine Water Soluble	200 grains
Potassium Bichromate	30 „
Gelatine	30 „
Water	1 pint

PROCEDURE —Dissolve the dye and gelatine in about 12 fl oz of water with the aid of gentle heat, and add the bichromate, dissolved in the remainder of the water

VIII

Galls	1 sr
Logwood Raspings	½ sr
Ferrous Sulphate	½ sr
Copper Sulphate	2 ch
Gum	6 ch
Sugar	2 ch
Water	12½ srs

PROCEDURE —The logwood is boiled with the water till half of the liquid is evaporated The decoction is filtered hot, and the other ingredients are dissolved in it As soon as ink

is cleared which takes about three days, it is run off from the sediment and bottled.

IX.

	A.	B.
Galls	1 sr.	3 srs.
Logwood Shavings	1 sr.	1¾ ch.
Ferrous Sulphate	1 sr.	3 srs.
Gum	1 sr.	3 srs.
Water	20 srs.	25 srs.
Vinegar	20 srs.	5 srs.

PROCEDURE:—Gallnuts, ferrous sulphate and the gum are dissolved in the vinegar and a decoction is made in a separate vessel with logwood shavings and water by boiling. The two decoctions are then mixed. The water which escapes during boiling is added when the preparation is complete.

X.

Aleppo Gallnuts (powdered)	6 parts.
Gum Arabic	1¾ "
Sulphate of Iron	2 "
Water	90 "

PROCEDURE:—Boil the gallnuts three times, and after each boiling add sufficient water to replace the loss by evaporation. Then strain the decoction and add to it the sulphate of iron and gum previously dissolved in the smallest quantity of water. The mixture is

allowed to stand quietly for a few weeks, the supernatant liquid is then poured off, and a few drops of creosote are added to prevent moulding

XI.

Logwood Extract Solution	20 oz
Potassium Bichromate	90 grs
Chrome Alum	5 oz
Oxalic Acid	1 oz
Carbolic Acid	1 dr
Distilled Water	q s

PROCEDURE:—Mix the extract solution with 50 oz of water, heat on a water bath to 90°C, add the potassium bichromate, chrome alum, and oxalic acid previously dissolved in 15 oz. of water Continue heating for half an hour keeping the temperature constant, then add enough water so as to make the mixture weigh 100 oz and also the carbolic acid Set aside for 2 or 3 days and decant the clear liquid

XII (CHROME INK)

Logwood extract	1 oz.
Gum	½ ,,
Water	2 pints

PROCEDURE:—Dissolve the gum, and logwood extract in the water. At the same time dissolve in another vessel 1 oz of yellow chromate of potash and mix the two solutions. The ink is ready for immediate use

XIII.

Extract of Logwood	3	oz.
Sulphate of Iron	6	"
Gum Acacia	5	"
Potassium Bichromate	4	dr.
Nigrosine	1	oz.
Water	80	"

PROCEDURE:—Boil together the first four ingredients and continue heating till the ferrous sulphate and gum acacia are fully dissolved. Next add to this the other ingredients, while the solution is still hot and agitate thoroughly. Finally strain through muslin.

XIV.

Aleppo Gallnuts	8	parts.
Logwood	4	"
Water	200	"
Copperas	4	"
Gum Arabic	3	"
Blue Vitriol	1	part.
White Sugar	1	"

PROCEDURE:—First of all the gallnuts are bruised and powdered; logwood is also made into thin shavings. Then the gallnuts and logwood are boiled for one hour in water till the whole is reduced to half. The whole is then strained through cloth and to this are added the copperas and blue vitriol in finely powdered condition and the gum arabic previously dissolved in a small part of water. Finally add white sugar and allow the mixture

to stand for one day. Strain again and preserve in closed bottles

XV.

Gallnuts	6½ lbs
Ferric Oxide	3 ,,
Wood Spirit	4½ ,,
Gum Senegal	2¾ ,,

PROCEDURE:—Pulverize 6½ pounds of the best black gallnuts, pour as much water over them as they will absorb, and place them upon a perforated bottom in a barrel provided with several layers of cut straw A sufficient quantity of soft water is now gradually poured over the moistened gallnuts to give 6 gallons of a clear decoction of a dark-brown colour A corresponding quantity of dissolved sulphate of iron is brought at the same time to the boiling point in a suitable earthen vessel, and oxidised with nitric acid during the boiling. The oxidised solution of iron is then precipitated with crystallized carbonate of soda dissolved in the necessary quantity of water. The precipitate is placed in a linen bag, washed out, and pressed with a gradually increasing pressure until it is of such a consistency that the cake, after the press-cloth has been removed, will cling together and not moisten blotting paper. Three pounds of this pressed ferric oxide is then stirred together with 4½ pounds of good crude wood spirit, and added, with constant stirring, to the 6 gallons

of decoction of gallnuts. The mixture is allowed to stand for a few days, being frequently stirred, and then $2\frac{3}{4}$ pounds of gum Senegal is added, and the mixture stirred until the gum is dissolved.

XVI. (Catechu Ink).

Catechu	1	lb.
Green Vitriol	1	„
Gum Arabic	6	oz.
Carbolic Acid	$\frac{1}{2}$	dram.
Boiling Water	1	gallon.

Procedure:—Dissolve the catechu in boiling water and strain; then add to it the other ingredients and stir until dissolved. Next set aside the ink for a few days, shaking frequently. Lastly strain through a piece of cloth and bottle.

POINTS OF SUCCESS.

(1). When the ink gets clotty and long threads spin from the nib due to the presence of excess of sugar, which has undergone fermentation, shake the ink with a freshly prepared gall solution and allow to stand. A tough black precipitate forms which settles below. The supernatant liquor is then decanted off and packed.

(2). Ink prepared from gallnuts and sulphate of iron has but a dull colour. This may be obviated by adding a small quantity of sugar or sulphate of copper which would

also give the ink a lustre. Preference is generally given to copper sulphate.

(3). To prevent the ink from moulding an addition of creosote or carbolic acid is highly recommended. One drop of creosote thoroughly stirred in suffices for 1 quart of ink. A slight addition of salicylic acid also prevents the formation of mould even in open ink stands.

(4). It frequently happens that an ink which is black at first assumes in course of time a yellowish tint. This is prevented by adding 2 ounces of caustic aqua ammonia to every pound of sulphate of iron given in the recipe.

(5). Salicylic acid which is added as a preservative must be added solid or dissolved in a little spirit.

(6). It is always advisable when adding boric acid to hang it in a bag in the ink so that it will gradually dissolve.

(7). Iron cauldrons may be employed for making black inks but metallic vessels should not be used during the manufacture of coloured inks. Earthen vessels or enamelled vessels are the most suited for the latter purpose.

(8). The solid ingredients in the ink may be put in a bag and hung immersed in water for obtaining the extract. A wooden ring round the mouth of the bag facilitates the filling and emptying.

(9). The ink as it is made is allowed to settle for a day or two before packing. The sediment left may be utilised in marking packing boxes, etc.

(10). When the ink gets thick due to evaporation of water, restore it to original volume by dilution with water.

(11). Full precautions for preserving the ink are always to be taken. References to pages 28 and 32 will be helpful.

(12). Always pack the ink bottles airtight and seal the mouth with pitch.

CHAPTER V

COLOURED INKS

THE INGREDIENTS

COLOURED inks are as already mentioned used for special purposes and for fountain pens Formerly a wide variety of substances of vegetable mineral and animal origin were employed for making coloured inks It often happened that the extraction of colour and rendering it permanent were accompanied with much difficulty The discovery of coal tar colours has however, much simplified the matter The only thing necessary is to select a colour and dissolve it in water—no question of preserving or disinfecting the ink arises

But as the colour solution of aniline dyes is mostly fleeting, the manufacturers should for better results use only such colours the solutions of which will not fade away with time Another thing to be noted in this connection is that ordinary water which often contains many chemical impurities in solution reacts on the dyes with the consequence that the original colour is lost The best thing is therefore to use distilled water when coal tar dyes are used, but when natural dyes are employed ordinary water may be used without any injury

HINTS ON PREPARATION.

The coloured inks prepared with aniline dyes must not be made too concentrated. If the writing, when dry, has a metallic lustre, the ink should be diluted at once. The inks do not require an addition of gum but if desired 1 part of dextrine may be added to 100 parts of ink. Some of these inks are very easily affected by other inks so that a pen used for one must not be dipped into another.

The best varieties of coloured inks which leave little sediment, can be used as fountain pen inks. In addition to the recipes that follow a lot of receipts will be found in the Chapter on *Fountain Pen Ink.*

RED INKS.

I.

Brazil Wood	30	ch.
Lodh Wood	10	,,
Water	10	srs.
Alum	2	ch.
Gum Arabic	2½	srs.
Pure Red	1	oz.

PROCEDURE:—Brazil and lodh wood are first powdered well and are covered over with water in an earthen vessel. Bring the whole to a boil and when it is reduced to half, add the alum and after some time the gum arabic. When one quarter of the liquid is left, it is removed from fire and allowed to cool. Strain

the red extract and add pure red Strain again after 24 hours and pack air-tight.

II.

Brazil Wood	2 oz
Gum Arabic	½ „
Alum	2 dr
Water	1 sr

PROCEDURE:—Bring the water to a boil in an earthen vessel and then throw in the Brazil wood previously powdered finely After some time a red colour will develop and can be tested by writing with a pen Then add powdered alum and then the powdered gum arabic. Boiling should be continued all this time When half a seer of water is left, remove from fire and pack after filtering this when cool

III

Brazil Wood	2 ch
Alum	1 „
Water	1½ srs
Cream of Tartar	½ ch
Gum Arabic	½ „
Rectified Spirit	3 oz
Cochineal Tincture	1 dr.

PROCEDURE:—2 chhataks of powdered Brazil wood is boiled in 1½ seers of water in an earthen vessel. When boiling occurs, add the alum in powder form and after a short time stir in the cream of tartar Boiling is

continued and when the whole is reduced to half, gum arabic in powdered condition is incorporated into the mass. Remove from fire and when cold add the rectified spirit and the tincture of cochineal one by one. Strain and pack airtight. This will yield a good red ink.

IV.

Carmine	6	parts.
Ammonia	15	„
Tartaric Acid	2	„

PROCEDURE:—Ammonia is first of all diluted to double its volume. Now introduce the carmine into it which will gradually dissolve. Finally add the tartaric acid. The mixture is allowed to stand for 2 to 3 days. After that period the supernatant red fluid is poured off. The sediment is then filtered through filter cloth and the ink adhering to it is drained off.

V.

Red Carmine	4	parts.
Liquid Water Glass (Sodium Silicate)	50	„
Rain Water	450	„

PROCEDURE:—Macerate the red carmine fine with the water glass and dilute the resulting compound with rain water. Allow to stand quietly for a few days and decant off the red ink.

VI.

Eosine	144	gr.
Sugar	288	,,
Distilled Water	20	fl oz

PROCEDURE.—Mix the dye with 1 fl oz of cold water, set aside for 2 hours, add the remainder of the water, still hot, and the sugar, and stir until dissolved

VII

Cochineal	1	oz
Ammonia	1	oz
Water	1	quart

PROCEDURE.—Make a decoction with the above. The infusion should be decanted after three days and then diluted with water to the required intensity of colour To preserve, a little antiseptic is added.

VIII

Brazil Wood (powdered)	1	lb
Acetic Acid (5 per cent strength)	1	gallon
Gum Arabic	8	oz
Alum	8	oz.

IX.

Eosin (yellow shade)	1	oz.
Gum Arabic	1	oz.
Distilled Water		q. s.

Procedure:—Dissolve the gum arabic in 2½ gallons of hot distilled water and the colour in 5 pints of distilled water. Then gradually stir the colour solution into the hot gum arabic mucilage.

X.

Erythrosine	4	parts.
Gum	4	„
Boric Acid	4	„
Distilled Water	40	„

Procedure:—Dissolve the gum arabic and the erythrosine in water separately. Finally add the boric acid.

Violet Inks.

I.

Brazil Wood (powdered)	3½	srs.
Lodh Wood (powdered)	1¼	„
Water	20	„
Alum	4	ch.
Pure Blue	4	dr.

Procedure:—The powdered Brazil wood and lodh wood are steeped in water in an earthen vessel. Boil the whole over a slow fire and agitate the mass from time to time with a piece of wood. When half the mass remains, add the alum. The whole is to be

removed from fire when a quarter of the mass is left. Then strain after cooling, and mix the colour intimately After 24 hours strain again and pack air-tight.

II

Scarlet Powder	4	oz
Water	12	srs
Pure Blue	1	oz

PROCEDURE —12 seers of water is first brought to a boil in an earthen vessel The scarlet powder is then tied in a piece of cloth and is immersed into the boiling water and moved to and fro When all the dye has dissolved out, remove the pan from fire and strain The pure blue is tied in another piece of cloth and steeped into this extract for 48 hours The colour should be wholly dissolved by this time If any remains, bring this out by wringing Finally strain and pack air-tight

III.

Scarlet Dye	½	oz
Acid Blue	2	dr.
Gum Arabic	1	,,
Water	3	bottles
Rectified Spirit	1	oz

PROCEDURE·—First mix the scarlet dye and the acid blue together and macerate them thoroughly with rectified spirit in a stone mortar Add this to the prescribed amount of clear water After 24 hours strain through

a piece of cloth and finally bottle air-tight and seal the mouth with pitch.

IV.

Indigo blue ink when mixed with cochineal ink, yields a good violet ink.

Blue Ink.

I.

Resorcin Blue M	48	grs.
Sugar	192	,,
Oxalic Acid	10	,,
Distilled Water	19½	fl. oz.

Procedure:—Mix the dye with 1 fl. oz. of cold water, set aside for two hours, then add the remainder of the water, in the hot state, and the other ingredients, and stir until dissolved. Any other water-soluble blue may be used such as phenol blue, acid blue, etc.

II.

Indigo Carmine	10	parts.
Water	75	,,
Gum Arabic	5	,,

Procedure:—Dissolve the gum and indigo carmine in water. Boil, filter and bottle.

III.

Chinese Blue	3	dr.
Bi-oxalate of Potash	1	,,
Gum Arabic	1	,,
Water	7	oz.

PROCEDURE:—Macerate first the blue and the potash with a little water in a stone mortar and to this add the whole of water. Next mix the powdered gum arabic. Strain after 24 hours and bottle

IV

Pure Blue	8	oz
Water	12	srs

PROCEDURE·—12 seers of water is boiled for an hour and then allowed to cool Pure blue is then tied in a piece of cloth which is then steeped in cold water for 24-hours. Then wring out the colour carefully Finally strain and pack air-tight

V.

Fast Blue	1¼	lbs
Powdered Gum Arabic	1¼	,,
Water	8	gallons

PROCEDURE:—Boil the gum in water, then stir in the blue and strain when dissolved

VI.

Chinese Blue	2	lbs
Oxalic Acid	1	lb.
Water	10	gallons

PROCEDURE:—Boil the water, pour about 4 gallons over the blue and acid, stir up well, then add the remaining water, stir and strain Never use cold water in making the fluid or the blue is likely to settle

GREEN INKS.

I.

Annatto Seeds	1	sr.
Alum	2	ch.
Water	5	srs.
Kamela Dye Powder	8	ch.
Pure Blue	4	"

PROCEDURE:—First of all the alum is dissolved in water which is then boiled for some time. Then remove from fire and allow the annatto seeds to soak in this solution for 12 hours. Then the whole is again boiled over a slow fire and to this is added the kamela dye. Go on boiling till the whole is reduced to half. Then remove from fire and allow to cool. When cold, stir in the colour. Finally strain and pack air-tight.

II.

Deep Green Dye	1	oz.
Gum Arabic	½	"
Water	3	srs.

PROCEDURE:—Gum arabic is finely powdered and mixed with deep green dye. These are then macerated in a stone mortar with a little water and made into a paste. When the whole is thoroughly incorporated, add 3 seers of water. Finally strain through cloth and bottle air-tight.

III.

Cream of Tartar	1	part.
Verdigris	2	parts.
Water	8	"

PROCEDURE —Dissolve the ingredients in water and boil to the required consistency

IV

Potassium Chromate	10	parts
Hydrochloric Acid	10	,
Alcohol	10	,,
Water	30	

PROCEDURE —Mix the ingredients and neutralise with sodium carbonate after reduction to the chromic salt Then add 10 parts of gum and decant

GREEN CHROME INK

Bichromate of Potash	10	oz
Hydrochloric Acid	10	
Spirit of Wine	10	,
Gum	10	,
Water	30	
Sodium Carbonate		q s

PROCEDURE —Powder the bichromate of potash finely and mix this with the acid, then let it stand for an hour A red solution will be obtained Slowly pour into this the spirit of wine with constant stirring A vigorous reaction takes place, and the liquid froths and gets very hot, and gradually turns to a dark green If the action gets too violet, a little cold water is put in To avoid boiling over, it is best to add the spirit in portions, waiting till the frothing after each addition is over before adding the next The next step is to add the

carbonate of soda, little by little, till all effervescence has ceased and a greenish precipitate begins to form. The liquid is then left covered for a week, filtered from the salt which has crystallised out and diluted to the desired colour. Finally the gum is dissolved in it.

This ink is absolutely permanent, and is very difficult to erase.

YELLOW INKS.

I.

Yellow Dye	1	oz.
Gum Arabic	2	dr.
Alum	1	,,
Water	2	srs.

PROCEDURE:—Water is brought to a boil and to this is then added the yellow dye. When mixed intimately, add the gum arabic, previously powdered. After 24 hours add the powdered alum and finally filter and bottle.

II.

Jack Wood	2	srs.
Water	16	,,
Alum	4	ch.
Gum Arabic	1	,,
Yellow Dye	1	oz.

PROCEDURE:—The jack wood is first of all stripped of its bark and the unsubstantial parts are removed. Only the heart-wood is used for ink making. 2 seers of this heart-wood is dried and powdered. This is stirred

into 16 seers of water which is then brought to a boil over a slow fire When three quarters of the liquid are left, add the powdered alum Heating is continued and when the whole is reduced to half, introduce the gum arabic The liquid is further heated and when one quarter only is left put in the dye and mix intimately Finally strain and pack air tight

GOLDEN INK

Bronze Powder	1 oz
Gum Arabic	q s

PROCEDURE —Bronze powder, which is generally used for the production of golden colour in printing works, may be employed for the manufacture of golden ink The powder is well incorporated in water into which gum arabic has been dissolved After writing when the ink is dry, the paper is to be polished with a conch shell for better effect

RICH BROWN

Fustic	6½ lbs
Madder	1¼
Gum Arabic (powder)	1¼ ,
Water	12 gallons

PROCEDURE —Boil all steadily for 2 hours, then strain Alizarine red may replace the madder if necessary

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CHAPTER VI.

FOUNTAIN PEN INK.

THE fountain pen has become a necessity to-day in all forms of correspondence. In the school, in the home and in business office it fills an important place. People are particular about the kind of pen they use but often forget the important matter of using the best kind of writing ink. The use of one single brand of ink in a fountain pen is commended. It is also desirable to use one colour and not to change frequently from blue black to blue or red or black in the same pen, for it is never possible to wash a fountain pen thoroughly clean especially in the self-filling pen which has a rubber sack.

ESSENTIALS OF FOUNTAIN PEN INK.

In manufacturing fountain pen inks one has to take particular care that the ink flows freely and does not thicken. The ink should not leave any sediment on evaporation Black fountain pen inks are rarely used. In such cases extract of logwood is used along with chromate of potash but the employment of gallic acids and tannic acids in place of gallnuts is to be recommended. Acids such as hydrochloric, sulphuric, acetic, etc., are added to a

small degree to dissolve any precipitate that may be separated. Blue black and coloured fountain pen inks are, however, much in vogue as they are easy to prepare and the deposition of sediment may be easily averted Diverse ingredients may be employed for the purpose. But synthetic colours are now mostly in use. Only the highly soluble colours are selected and the ink remains fluid and does not get clotty or stringy, which will frustrate the purpose for which the ink is made.

It may be mentioned here that the best ink free from sediments and possessing all the essentials for writing fluid, may be used for writing with a fountain or stylo pen. A few recipes follow:—

BLUE BLACK INK.

I.

The recipe stated below is said to have the same composition as Duncan Clock-hart and Co 's celebrated bluish black ink.

Alleppo Gallnuts	4½ oz.
Cloves (pulverised)	1 dr.
Distilled Water	40 oz.
Sulphate of Iron	1½ ,,
Sulphuric Acid (pure)	25 grains.
Sulphindigotic Acid (or, Indigo Carmine)	¼ oz.

PROCEDURE:—The gallnuts are placed with the cloves into a flask. Then water is poured over them and they are allowed

to digest, being frequently shaken. The fluid is then filtered into another flask of the same size. The sulphate of iron is now added, and when entirely dissolved the acid is poured into the mixture and the whole quickly shaken; finally, the indigo carmine is added and mixed with the compound by shaking. Filter and pack.

II.

Extract of Logwood	3½ drs.
Alum	20 grs.
Indigo Carmine	30 grs.
Sulphate of Iron	6 grs.
Potassium Bichromate	4 grs.
Copper Sulphate	4 grs.
Gum Arabic	3 grs.
Distilled Water	2½ oz.

PROCEDURE:—Dissolve the extract of logwood in 1 ounce of distilled water; then dissolve the other ingredients in 1½ oz. of water. Mix the two fluids and allow it to settle and then filter.

III.

Phenol Black B	2¼ av. oz.
Sugar	2¼ av. oz.
Carbolic Acid	1 fl. dr.
Sulphuric Acid (pure)	25 minims.
Distilled Water	96 fl. oz.

PROCEDURE:—Mix the dye with 6 fl. oz. of cold water, allow to stand for 2 hours, then add the remainder of the water in the boiling condition, and the other ingredients and stir

well until dissolved A handsome blue black ink is obtained For ordinary purposes the proportion of the dye may be reduced to 1½ av oz

IV

Gallnuts	3 oz
Ferrous Sulphate	1 oz
Gum Arabic	1 oz
Vinegar	1 oz
Indigo Carmine	q s
Water to make	24 oz

PROCEDURE —The gallnuts are first of all bruised and ferrous sulphate and gum arabic powdered These are macerated in water sufficient to yield 24 oz of ink The whole is shaken frequently for 14 days and the clear ink is decanted Finally add the indigo carmine The blue black effect is permanent

V

Bengal Green	5 gr
Methyl Violet	4 gr
Bismarck Brown	2 gr
Gum Arabic	20 gr
Water	4 oz

PROCEDURE —The colours are simply dissolved in distilled water and a little gum arabic is added to maintain the fluidity of the ink

VI

Nigrosin	½ oz
Soluble Blue	4 oz
Water	q s

PROCEDURE:—Mix the ingredients in sufficient quantity of water to give the desired shade.

VII.

Gallnuts	9	lbs.
Gum Arabic	3½	lbs.
Sugar	3½	lbs.
Blue Black	10	oz.
Glycerine	8	oz.
Curd Soap	6	oz.
Cloves	4	oz.
Distilled Water	10	gallons.
Methylated Spirit	½	gallon.

PROCEDURE:—Boil the galls and cloves in the water for about 1 hour. Add the gum and sugar, simmering only till dissolved. Then add glycerine and soap; stir and put in blue black when dissolved, stirring round well; cool down, pour the spirit in, strain twice, and bottle.

VIII.

Gallnuts	13	oz.
Gum Arabic	5	oz.
Sulphuric Acid	5	oz.
Blue Black	3	oz.
Cloves	½	oz.
Sulphate of Iron	½	oz.
Pyrogallic Acid	30	grains.
Distilled Water	1	gallon.

PROCEDURE:—Boil galls, gum and cloves in the water for 20 minutes; and sulphate of iron and pyrogallic acid, cool, pour in

sulphuric acid slowly, stirring in blue black last. Strain well

IX.

Gallic Acid	1 oz.
Tannin	3 oz.
Gum Arabic	1 dr
Carbolic Acid	1 dr.
Ferrous Sulphate	2 oz.
Ferric Chloride	
Solution 10 p c.	1 oz.
Indigotin	1½ oz.
Water	7½ pints.

PROCEDURE:—Dissolve the gallic acid and tannin in 6 pints of hot water and dissolve the other ingredients in the remaining portion of water without the application of heat Then mix the two solutions and set aside for a fortnight and filter before bottling

X.

Gallnuts	13 oz.
Gum Arabic	5 oz.
Ferrous Sulphate	½ oz.
Pyrogallic Acid	30 gr.
Sulphuric Acid (Comml.)	5 oz.
William's Blue-Black	3 oz.
Cloves	½ oz.
Distilled Water	1 gallon.

PROCEDURE:—Boil the gallnuts, gum arabic and cloves in the water for about 20 minutes and then add ferrous sulphate and pyrogallic acid Allow to cool and pour in

sulphuric acid slowly. Finally stir in the blue-black, strain well and bottle.

XI.

Tannic Acid	2¼ oz.
Gallic Acid	¾ "
Ferrous Sulphate	3 "
Hydrochloric Acid (dilute)	2½ fl. oz.
Carbolic Acid	75 grs.
Acid Blue	¼ oz.
Distilled Water to produce	5 pints.

PROCEDURE:—Dissolve the tannic and gallic acids in about 5 oz. of warm water. Cool. Dissolve the ferrous sulphate in about 15 oz. of cold water. Add the hydrochloric acid and immediately mix the two solutions. Add the carbolic acid, acid blue and sufficient water to make 5 pints.

XII.

Nutgall Ink (good)	5 gallons.
Distilled Water	4½ "
Chinese Blue	¾ lb.
Oxalic Acid	4½ oz.

PROCEDURE:—Pour the boiling distilled water upon the blue and acid. Stir well and leave till nearly cold, then re-stir until that at the bottom has entered into solution. It is preferable to add the gall ink warm and it should be heating up while the stirring is being done. Then mix, stir again, and strain through a piece of cloth.

BLACK.

I.

Tannic Acid	1	oz
Pyrogallic Acid	½	dr
Sulphate of Iron	1	oz.
Pyoktannin	½	dr.
Tartaric Acid	1	oz.
Water	6	pints

PROCEDURE:—Warm the water and add the ingredients one by one Shake well to dissolve Set aside for a few days shaking occasionally, strain through cotton wool, and add 1½ oz of fresh mucilage

II.

Methyl Violet	6	grains
Bengal Green	10	"
Bismarck Brown	4	"
Gum Acacia	60	"
Water	8	fl oz.

PROCEDURE.—As in (I)

III.

Nigrosine (water soluble)	2	parts
Distilled Water	160	"

PROCEDURE.—Dissolve the nigrosine in the distilled water and filter

IV.

Pure Water Black	2	lbs
Gum Arabic	2½	"
Sugar	2	"
Glycerine	4	oz
Distilled Water	6	gallons

PROCEDURE:—Boil the gum, sugar, and glycerine in the water until the former two are dissolved; then while the solution is hot (but not boiling) add the water black with nearly continual stirring until the ink is cool. Then thoroughly strain before bottling.

RED INK.

I.

Eosine	1	part.
Distilled Water	80	parts.

PROCEDURE:—Dissolve the eosine in distilled water. Filter the whole before bottling.

II.

Magenta or Eosin	2	oz.
Gum	5	„
Spirit	10	„
Water	100	„

PROCEDURE:—The colour is first dissolved in the spirit with the aid of gentle heat. The gum is dissolved in water in a separate vessel and filtered. The solution of gum is then heated and as soon as it begins to boil the colour solution is added to it in a thin stream with continuous stirring.

Magenta may be replaced by eosin when an almost equally good ink will be produced.

BLUE INK.

I.

Induline	4	parts.
Distilled Water	320	„

PROCEDURE:—Dissolve and bottle.

II

Gallic Acid	8	grains.
Ferrous Sulphate	12	„
Phenol Blue	2	„
Gum Acacia	16	„
Sulphuric Acid (dilute)	24	minums.
Carbolic Acid	3	„
Glycerine	14	„
Distilled Water to make	20	fl oz

PROCEDURE:—The ferrous sulphate in powder form, gum acacia, carbolic acid, glycerine and dilute sulphuric acid are dissolved in 8 ounces of the water, without heat Dissolve the gallic acid in 5 ounces of the water, using gentle heat, raise to boiling water, and add the first solution gradually, shaking after each addition Make up to 20 fl oz, filter and add phenol blue, shaking until dissolved

III

Indigo Carmine	2	parts
Gum	1	part.
Water	10-20	parts

PROCEDURE:—Gum is first dissolved in a small quantity of water and the carmine is introduced into it Finally add more water till the desired shade of colour is obtained Now strain and pack air-tight

IV.

Potassium Ferrocyanide	17	parts
Ferrous Sulphate	17	„

Nitric Acid	10	parts.
Hydrochloric Acid	5	,,
Water	2,100	,,
Oxalic Acid	3½	,,
Gum	160	,,

PROCEDURE:—Potassium ferrocyanide is first dissolved in thrice its weight of water and the ferrous sulphate in 90 times its weight of water. Mix when a bright blue precipitate known as Turnbull's blue will be obtained. Finally treat the precipitate with the nitric acid, hydrochloric acid and 500 parts of water. After 24 hours the liquid is poured off and the precipitate is rubbed up with 3½ parts of oxalic acid. Then add 4,000 parts of water containing 160 parts of white gum in solution. Finally strain and pack air-tight.

GREEN.

I.

Green inks can be produced by mixing blue and yellow inks in suitable proportions, or by dissolving aniline dyestuffs such as Neptune Green S. G., Diamond G & B, Light Green S. F. in 80 times its weight of water. A little spirit may be added as in the case of red to help quick drying.

II.

A.	Indigo Carmine	12	ch.
	Gum	1¾	seers.
	Water	18	,,

B. Picric Acid 1½ ch.
Boiling Water 4½ seers.

PROCEDURE:—The indigo carmine and gum are first dissolved in cold water. In another vessel solution is effected of picric acid in boiling water. Finally the two are mixed when a good green ink will be obtained

POINTS FOR SUCCESS.

Precaution should be taken that the ink does not deposit sediment on keeping. To avoid this drawback just sufficient quantity of acetic, hydrochloric or sulphuric acid should be added.

Only use colours as are highly soluble in water. Otherwise as the ink evaporates a part of the colour may be deposited.

Follow other directions given in connection with Writing Inks

CHAPTER VII.

INK POWDERS AND TABLETS.

THEIR UTILITY.

INK powders and tablets are solid masses which when dissolved either in cold or hot water at once give a nice writing ink. Owing to the difficulties experienced in transporting fluid inks, these powders and tablets have in these days come into use in enormous quantities. Generally where a great writing business is done, no one would use these powders but they are very useful in travelling, when a writing ink can be made in an instant.

INK POWDER.

Any ink, if evaporated, gives a residue at the bottom of the vessel and this residue can be used as the ink powder for that ink. But there are many colouring substances and synthetic dyes which when dissolved give a fine writing ink. A list of them follows under ink powders.

During the process of manufacturing ink powder from vegetable sources care should be taken that the ink is evaporated throughout at a low temperature so that no portion of it may get burnt. For best effect the ingredients should be in a state of perfectly uniform

mixture. Gallnut extract is often required for making ink tablets or powders. To prepare it the galls are extracted with boiling water and the filtered decoction is carefully evaporated to dryness

It may also be remarked here that ink powders are generally found packed in paper pieces or bags but this system is faulty, as the ingredients that go to form the ink powder are likely to suffer thereby, not to speak of the damage done to the paper packets. These ink powders should, as far as practicable, be packed in air-tight wooden boxes, or if paper boxes are to be used at all, they should be once dipped into boiling paraffin, to make them air-tight A few recipes of ink powders follow·

BLUE BLACK.

Gallnuts (Powdered)	2¾	lbs
Sulphate of Iron	1	lb.
Gum Arabic (Powdered)	½	„
Sugar (Powdered)	¼	„
Blue Black	¼	„

PROCEDURE:—Mix well. Put into two oz. packets. This when dissolved in boiling water and strained when cool will give one pint of ink.

II.

Ferrous Sulphate (Dry Powder)	132	parts.
Gallic Acid (Dry Powder)	140	„

Tannic Acid (Dry Powder)	17	parts.
Indigotin (Dry Powder)	245	,,

PROCEDURE:—Mix well. About 7½ grains of ink powder should be added to each fluid oz. of soft water. To make a compressed tablet, add 10 per cent. dry powdered cane sugar.

III.

Tannic Acid	4	oz.
Green Copperas (Dry Powder)	14	drs.
Gum Arabic (Dry Powder)	2	,,
Sugar	2	oz.
Blue Aniline	4	dr.

PROCEDURE:—Mix well. One oz. of the powder will give 12 oz. of ink.

IV.

Hemolin	4	oz.
Oxalic Acid	1½	,,
Blue Aniline	4	dr.

PROCEDURE:—Mix well. One oz. of the powder will give 16 oz. of ink.

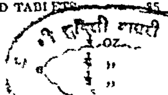
V.

Naphthol Black Aniline	2	oz.
Oxalic Acid	1	,,
Gallic Acid	2	,,
Molybdic Acid	2	dr.
Blue Aniline	1	oz.

PROCEDURE:—As in (IV).

VI.

Nutgalls	1⅔	oz.
Sulphate of Iron	½	,,



Gum Arabic	1 oz.
Alum	¼ "
Chinese Blue	¼ "

PROCEDURE —Mix together all the ingredients after bruising them to fine powders and divide into 20 parts A fair ink can be made promptly by putting one of these portions into a cupful of boiling water

PALE BLUF BLACK

Gallic Acid	2 oz
Green Copperas (Dry Powder)	3 ,
Blue Aniline	1 ,

PROCEDURE —As in (IV)

STYLOGRAPHIC BLUE BLACK

Magenta Aniline	½ oz
Green Aniline	½ ,
Oxalic Acid	1 dr

PROCEDURE —Mix well This will give 8 pints of stylographic ink

BLACK

Gall Extract (Powder)	14 oz
Ferrous Sulphate	10 ,
Gum	5 "
Alum	2 ,

PROCEDURE —The galls and alum are ground fine, and then the gum and the ferrous sulphate are powdered separately and mixed with the above Take care that all the ingre

dients are well dried. The powder should be packed at once.

II.

Gall Extract	30	oz.
Ferrous Sulphate	5	„
Copper Sulphate	1	„
Alum	2	„
Gum	2	„

PROCEDURE:—All the ingredients are first dried well and then after being powdered finely, are mixed. This powder gives an ink of the highest quality.

III.

Logwood Extract	100	*parts.*
Bichromate of Potash	1	*part.*
Indigo		q.s.

PROCEDURE:—Pulverise and mix intimately the extract of logwood and the bichromate of potash. Finally add indigo one-tenth of *the whole in weight.*

IV.

Aniline Green D	9	parts.
Ponceau R. R.	8	„
Phenol Blue	1	part.

PROCEDURE:—The powders are mixed and packed. Dissolved in water it gives good black ink.

V.

Aleppo Gallnuts	14	parts.
Dutch Madder	1	part.
Iron Acetate	4	parts.
Tincture of Indigo	2½	„

PROCEDURE.—The Aleppo gallnuts and Dutch madder are first of all crushed powdered, mixed, moistened with water and packed into the percolator. An extract is then obtained by treating the mass with sufficient quantity of hot water and then by filtering and pressing out. Put into water bath and evaporate to dryness and powder the dry residue.

The ink is ready for use instantly on being dissolved in water. The powder may also be made into tablets by pressure in a tablet making machine.

JET BLACK

Nigrosine	3	oz
Blue Aniline	4	dr
Orange Aniline	2	,,
Dextrine	2	oz

PROCEDURE.—Mix. This will make 1 gallon of ink.

RED

Logwood Extract	100	oz
Aluminium Sulphate	40	,,
Potassium Oxalate	40	,,
Potassium Bisulphate	3	,,
Salicylic Acid	15	,,
Water		q s

PROCEDURE.—The salicylic acid is first dissolved in water and then the other ingredients are added one by one. Finally dry.

II

Brazil Wood (Ground)	7	lbs
Gum Arabic (Powder)	3	,,

Vermilline	3¼ lbs.
Acid Brown	¼ lb.
Citric Acid (Powder)	¼ „

PROCEDURE:—Well mix the last two, add to the vermilline, then to gum and wood. For use, one ounce will suffice for one pint of boiling water.

III.

Brazil Wood (Ground)	10½ lbs.
Gum Arabic (Powder)	2 „
Sugar (Powder)	1½ „
Vermilline	12 oz.
Cloves (Powder)	7 „

PROCEDURE:—As above.

BLUE.

Neutral Blue	2 lbs.
Oxalic Acid (Powder)	12 oz.
Gum Arabic (Powder)	4 „

PROCEDURE:—Mix as before, using but half an ounce to one pint of hot water.

VIOLET.

I.

Logwood Extract	100 oz.
Aluminium Sulphate	40 „
Potassium Oxalate	60 „
Potassium Bisulphate	10 „
Potassium Chromate	1 „
Salicylic Acid	1.5 „

PROCEDURE:—Mix intimately and pack.

II

Phenol Blue	3	parts
Ponceau R R	4	"

PROCEDURE.—Mix the two when a good violet ink powder will be obtained

BLUE GREEN

Phenol Blue	3	parts
Aniline Green	5	"

PROCEDURE —Mix the colours in powder form and pack air-tight

ANILINE DYE POWDERS

The principal dyes used in the manufacture of ink powders, etc, are as follows:—

Black—Nigrosine, Aniline Black

Blue—Indigo Carmine, Soluble Blue T and Acid Blue

Red—Eosin, Erythrosin, Scarlet, Ponceau Red R R, Cotton Scarlet.

Green—Neptune Green S. G, Diamond Green G, Aniline Green

Violet—Acid Violet 4 B L

Yellow—Fast Yellow or Tartrazin

COPYING INK POWDERS.

Ink powders of copying inks may be made but it is difficult to preserve them as they contain a small proportion of sugar

VIOLET.

Methyl Violet	10	parts
Sugar	5	"
Oxalic Acid	1	part.

RED.

Eosine	5	parts.
Sugar	10	,,

BLUE.

Resorcin Blue	5	parts.
Sugar	20	,,
Oxalic Acid	1	part.

BLUE BLACK.

Tannic Acid	3	parts
Gallic Acid	1	part.
Green Copperas (Dry Powder)	4	parts.
Blue Aniline	1	part.
Sugar	4	parts.

INK TABLETS.

Ink tablets are now-a-days more in request than the ink powder. These tablets are solid masses which dissolved in water form an ink and are now invariably made with a tablet making machine. These are specially convenient to travellers as these avoid the necessity of carrying bottles and the risks of breaking them.

INGREDIENTS.

The ingredients which make up the ink powder may be used for the preparation of ink tablets with the addition of a little binding agent such as gum, dextrine, etc. The presence of gum, sugar or dextrine also imparts a gloss to the tablets. To increase the bulk of the tablet the manufacturers generally use

soluble starch, but in this case the quality of ink suffers.

At present, however, almost all the ink tablets in the market are not inks proper but only German dyes, the bulk of which is increased by the addition of soluble starch. The colouring matters must be highly soluble in water, otherwise the ink made by dissolving the tablets will leave sediments which are to be avoided in all ink preparations. These tablets, it may be remarked, lack the properties of good quality inks

To prepare the tablets from the dyes, the colours are thoroughly powdered and mixed with starch, gum, dextrine, etc , which are also finely powdered The powders thus formed may be converted into tablets by means of a compressing machine, commonly known as a tablet making machine The pressure of the machine in the presence of gum, starch or dextrine causes them to form tablets without any other adhesive.

A few recipes of ink tablets follow:—

BLUE BLACK

Logwood Extract	100	parts.
Potassium Chromate	1	part
Gum	10	parts.
Indigo Carmine	20	,,

PROCEDURE.—Mix and press into tablets This gives a beautiful ink. The writing changes from a blue to a deep black.

II.

Ink Black	2½ lbs.
Blue Black	1½ „
Liquid Gum Arabic	1 lb.
Powdered Sugar	1 „

PROCEDURE:—Have all in powder, mix to a paste with gum and with a little water, if required and press into tablets. This quantity dissolved in water and strained is sufficient to give 100 pints of ink. This ink is also good for copying.

BLACK.

Nigrosine	2 parts.
Sugar	2 „
Dextrine	1 part.

PROCEDURE:—Mix and put up into packets when it will be used as powder or compress into tablets. Two parts of this powder when dissolved in 80 parts of water will give a fine black ink.

II.

Powdered Galls	4 lbs.
Ink Black	4 „
Liquid Gum Arabic	2½ „
Sulphate of Iron	1¼ „
Sugar Candy	4 oz.
Cream of Tartar	1½ „
Sulphate of Copper	1½ „

PROCEDURE:—Have all in powder, mix to a paste with the gum and a little water if required, then press into one ounce tablets and

dry One tablet is to be dissolved in 1 to 1½ pints of hot water

VIOLET

Logwood Extract	500	parts
Potassium Chromate	1	part
Alum	10	parts
Gum	20	,,

PROCEDURE —Mix and press into tablets

RED

Eosine	8	parts
Dextrine	4	
Sugar	8	,,

PROCEDURE —Mix the ingredients One part of this powder will give 40 parts of ink

II

Sugar (Powder)	3½	lbs
Vermilline	1¼	,,
Liquid Gum Arabic	1¼	,,
Glycerine	¼	lb
Bismarck Brown	¼	,,

PROCEDURE —Mix vermilline and Bismarck brown with sugar, add glycerine to the gum and make as previously A one ounce tablet will make one pint of ink

BLUE.

Chinese Blue	3	lbs
Oxalic Acid	1½	,,
Liquid Gum Arabic	1½	,,

PROCEDURE —Thoroughly mix oxalic acid with the blue, add gum and press into tablets.

One tablet is to be dissolved in one quart of boiling water.

CHROME.

I.

Logwood Extract	500	parts
Potassium Chromate	1	part.
Alum	10	parts
Gum	20	"

This gives a violet ink. Add sufficient water to get a perfect mixture.

II.

Logwood Extract	100	parts
Potassium Chromate	1	part.
Gum	10	parts.
Indigo Carmine	20	"

This gives a beautiful ink. This writing changes from a blue to a deep black.

POINTS OF SUCCESS.

(1). If starch is used in place of dextrine, use soluble starch only (page 21).

(2). Use highly water-soluble dyes: otherwise the colour will separate out and the proportion of the dye to be added will be unprofitably large.

(3). Don't use gum with synthetic dyes.

(4). When making ink powder from vegetable sources, evaporate the extract slowly.

(5). Pack air-tight; otherwise sugar in the tablet may absorb moisture.

CHAPTER VIII.

COPYING INKS.

PRINCIPLE OF MANUFACTURE.

THE chief purpose which the copying inks are to fulfil is that the writing executed with this may be copied within a space of 5 or 6 hours by passing it through a copying press which is now-a-days too well-known to require any description It will be evident therefore that in the preparation of copying inks an additional quantity of pigment should be used because the process of copying tends to make the original too faint to produce legible copies Moreover, it is necessary to have a certain proportion of gum or other adhesive materials in the body of the ink to attach this excess of colouring matter to the surface of the paper and to protect it from too rapid oxidation. It is also necessary that the ink should dry slowly Addition of some hygroscopic agent to keep the ink moist for some time is therefore commended Generally glycerine in small doses enters into the composition of copying inks but sugar, dextrine, grape sugar, calcium chloride may also be used for the purpose These prevent the gum from drying up completely in a small span of time. But care should be taken during manipulation that these

are not added in excess. In that case any excess quantity of glycerine will render the ink liable to smudge and the copies all blurred.

Mention may also be made here that ordinary writings should not be executed with copying inks. For if the ink is allowed to dry without taking a copy, the excess of gum present in the ink causes the original to stick to any paper which comes in contact with this and leaves an impression upon that. The original is also blurred to a great extent thereby. If however copying inks are to be used for ordinary purposes, the ink should be diluted with water so that the proportion of pigment and of the gum present in the ink may be lowered down considerably.

Ordinary writing inks made from gallnuts and iron sulphate or from logwood decoction may be rendered capable of giving one or two copies on a press by the addition of glycerine, gum, sugar, glucosides, etc., to a previously concentrated ink; 1 oz. of sugar candy or 1¼ oz. of sugar when added to 1½ pints of rich black ink yields ordinary copying ink. Good coloured copying inks are obtained by using concentrated solution of water-soluble aniline dyes with the addition of a small proportion of glycerol. The proportion of the dye to be used varies with the strength of the dye and on the number of copies required.

METHOD OF COPYING.

A copying press is necessary for taking copy of letters written with copying ink A sheet of blotting paper or an oilskin is placed under one of the tissue leaves of the copying press The leaf is wetted with a brush and afterwards pressed with another blotting paper to clear superfluous water and to leave it uniformly damp Upon the wet leaf is then placed the written portion of the letter, and then the book is placed under the copying press and uniform pressure is exerted After a few seconds the book is removed when a clear impression of the letter will be obtained

A few recipes of copying inks follow:—

BLACK.

I

Logwood Extract	1 seer.
Potassium Chromate	2½ tolas
Carbonate of Soda	4 ch
Glycerine	1 seer
Gum	4 ch
Water	4½ seers

PROCEDURE.—The logwood extract and sodium carbonate are dissolved in water Gum and glycerine are next added and lastly the chromate of potassium dissolved in the smallest quantity of hot water More than three copies may be taken with letters written with this ink This ink will give a copy without a press.

II.

Logwood Extract Solution (20 p.c.)	1,200	parts.
Sulphuric Acid	1	part.
Aluminium Sulphate	80	parts.
Oxalic Acid	80	"
Potassium Carbonate	80	"
Potassium Bichromate	8	"
Carbolic Acid	2	"
Water	500	"

PROCEDURE:—Sulphuric acid is mixed with logwood extract. The other ingredients are mixed separately in 500 parts of water. The two are then mixed together.

III.

Gallnuts	9	oz.
Logwood	4¾	"
Sulphate of Iron	4¾	"
Sulphate of Copper	3	"
Gum Arabic	3½	"
Rock Candy	1	"
Water		q. s.

PROCEDURE:—Boil 9 ounces of coarsely powdered gallnuts and 4¾ ounces of *ground logwood with 1¾ gallons of water until ¾ gallon of fluid remains, and filter through a cloth. Then dissolve 4¾ ounces of ordinary sulphate of iron, 3 ounces of sulphate of copper, 3½ ounces of gum-arabic, and 1 ounce of* rock candy in 1¾ quarts of water; add this solution to the above decoction, stir it

thoroughly, let it stand for 24 hours, and filter the ink from the sediment through a felt bag.

IV.

Gallnuts	8	parts
Ferrous Sulphate	4	,,
Gum Arabic	2	,,
Alum	1	part.
Indigo	1	,,
Vinegar	12	parts
Beer	60	,,

PROCEDURE:—Convert into a coarse powder 8 parts of Turkish gallnuts, 4 of sulphate of iron, 2 of gum-arabic, 1 of alum and 1 of indigo Place the ingredients in a flask, pour 12 parts of vinegar over them, and let them digest in a moderately warm place for 24 hours Then add 60 parts of beer, let it again stand in a warm place for a few days, when the ink is ready for use.

V.

Logwood Decoction (8°Be)	5	parts
Sugar	3	,,
Gum	2	,,
Glycerine	5	,,

PROCEDURE:—Ink which preserves the steel pen from oxidation is produced from 5 parts of decoction of logwood, of 8°Beaume, 3 of sugar, 2 of gum senegal, and 5 of glycerine

The fluid may be coloured violet by adding a solution of 20 parts of caustic potash and 3 of flowers of sulphur in 100 of water. The

substances are mixed in an iron boiler, 10 parts of leather waste added, and, with constant stirring, boiled down to dryness. Two hundred parts of water are then poured over the residue, the fluid is pressed out, and then filtered.

VI.

Chinese Blue	2 oz.
Oxalic Acid	1 ,,
Gum	q. s.
Water	30 oz.

PROCEDURE:—Take 2 oz. of Chinese blue in powder and 1 oz. of oxalic acid. Mix together and make into a thin paste with boiling water. When thoroughly uniform make up to 30 oz. or more, according to the strength required, with boiling water. This makes a permanent solution and with a little mucilage added, a very good copying ink.

VII.

Galls	3 seers.
Ferrous Sulphate	12 ch.
Gum	8 ,,
Grape Sugar	4 ,,
Water	25 seers.
Carbolic Acid	q. s.

PROCEDURE:—Make a decoction of gallnuts with water and add the other ingredients one by one. If the ink is sticky, mix it with some more ink made without either gum or grape sugar.

RED

Fuchsine	½ oz
Water	30 „
Glycerine	½ fl oz
Creosote	q s

PROCEDURE —Dissolve the fuchsine in 30 ounces of water and add the glycerine Finally add a few drops of creosote to make the ink keep for a good length of time

II

Eosine	5 parts
Sugar	6 „
Water	20 „

PROCEDURE —Dissolve the colour in cold distilled water and finally add the sugar

VIOLET

Methyl Violet	½ oz
Water	16 „
Glycerine	½ „
or, Gum Arabic	10 drams
Creosote	q s

PROCEDURE —The methyl violet is first of all dissolved in the water and glycerine is then added to it Gum arabic in proper proportions may also be added in place of glycerine Finally add a few drops of creosote to help the keeping quality of the ink

II

Methyl Violet, 3B	20 parts
Sugar	10 „

Oxalic Acid	2	parts.
Water	940	,,

PROCEDURE:—Dissolve the colour in warm water and then add the other ingredients.

BLUE.

Resorcin Blue	10	parts.
Water	950	,,
Sugar	10	,,
Oxalic Acid	2	,,

PROCEDURE:—Dissolve the colour in distilled water and finally add the others.

BLUE BLACK.

Logwood Extract	100	parts.
Ferrous Sulphate	4	,,
Potassium Chromate	1	part.
Indigo Carmine	8	parts.
Glycerine	10	,,
Water	500	,,

PROCEDURE:—Dissolve the extract, the ferrous sulphate and the potassium chromate simultaneously in water and then add the glycerine and the indigo carmine. This ink takes a long time to dry and so it can give many copies.

II.

Logwood Extract	6¼	seers.
Ferrous Sulphate	2	ch.
Copper Sulphate	1	,, .

Alum	12	seers.
Grape Sugar	8	ch.
Potassium Chromate	1	,,
Indigo Carmine	1	seer.
Water	31	seers.

PROCEDURE:—The extract of logwood, the indigo carmine and the sugar are dissolved in 25 seers of water. *The other ingredients* are dissolved in the rest of the water and the two solutions are then stirred together.

COLOURED INKS.

I.

Oxidsed Tannin Solution	600	parts.
Ferrois Sulphate	60	,,
Watei	350	,,
Dye		q. s.

PROCEIURE:—Dissolve the sulphate of iron in watr and mix the solution with the tannin soluton. It is set aside for 3 weeks when it is filered and diluted to 1,000 parts. Use the folloving dyes according to the colour of the ink to e manufactured,

Blue—Phuol Blue 2.5 parts.

Red—Poneau Red 6 parts.

Green—Ailine Green 6 parts.

Blue-Green—Phenol Blue 1.5 parts with Aniline Green 3 parts.

Violet—Pheol Blue 1.5 parts with Ponceau Red 2 parts

II.

Dissolve the dye in water and add a small proportion of glycerine. The proportion of the dye to be used varies with the strength of the dye and the number of copies required. Use the following colours:—

Violet—Methyl Violet 3B, Crystal Violet B, Methyl Violet O and III extra N.

Red—Eosin, Diamond Magenta, Magenta Powder, Safranine T extra B.

Black—Diamond Green B and G (B) with Diamond Magenta and Chrysoidine.

CHAPTER IX

RUBBER STAMPING INKS

ESSENTIALS OF GOOD STAMPING INKS

THE demand for stamping inks in the market is ever on the increase but reliable inks are rare in the market

A good rubber stamping ink must fulfil the following requirements —

1 The ink should give a clean impression and dry quickly on paper

2 The ink should not dry readily on the stuff

PRINCIPLE OF MANUFACTURE

In the making of rubber stamp inks special consideration is to be attached to the second factor Otherwise the engravings on the rubber will be chocked and cannot be cleaned with a brush without impairing its outlines, as can conveniently be done in the case of metal stamps, and the impression obtained will be too indistinct to be of any use

It is important to use no more glycerine as necessary to keep the dye dissolved when the mass is cold If the mass turns gritty on cooling, it must be heated up with more glycerine till the solution is perfect In dealing with coal tar dyes insoluble in glycerine or

nearly so, these are to be first dissolved in the least possible quantity of hot alcohol. The glycerine is then added and the whole is heated till the spirit is evaporated.

When the ink is ready, try with a stamp to see if the ink is all right. If the letters run at the edges, there is too much glycerine in the ink and more dye is to be added. If on the contrary the impression is indistinct and weak, the ink is too thick and must be diluted by carefully adding glycerine. When of the right consistency, the separate letters must be quite sharp and distinct. A few recipes follow:—

COLOURED INKS IN GENERAL.

I.

Aniline Dye	2	parts.
Oleic Acid	3	„
Castor Oil	50	„

PROCEDURE:—The aniline dyes taken should be oil-soluble; mix the dye with crude oleic acid. Finally pour down the mixture with castor oil. The proportion of the last ingredient may be increased or lessened according to the shade of colour desired. Inks of various colours may be obtained by incorporating oil-soluble aniline dyes of the colour desired.

II.

Dyestuffs	1 oz.
Glycerine	q.s.
Alcohol	q.s.

PROCEDURE —Take coal-tar dye of the desired colour The dye may be fuchsine (red), methyl violet, water blue, or, emerald green The dye is first dissolved in as small quantity of alcohol as possible The colour solution is then put in a thin porcelain dish over which concentrated glycerine is poured and the whole is heated to nearly 212°F or 100°C with constant stirring

III

Aniline Blue Soluble 1 B	3	parts
Distilled Water	10	„
Acetic Acid	10	„
Alcohol	10	„
Glycerine	70	„

PROCEDURE —The colour is first rubbed up with the water in a mortar, and the glyce rine is added gradually and then the other ingredients

For violet, red, green and other coloured rubber stamp inks the following aniline colours may be substituted in proportions given in the above recipe:

Methyl Violet, 3B (violet)	3	parts
Diamond Fuchsine I, (red)	2	„
Methyl Green (yellowish)	4	„
Vesuvin, B (brown)	5	„
Nigrosine, W (blue black)	4	„

For very bright red 3 parts of Eosin B B N are used In this case the acetic acid must be omitted

IV.

Dyestuff		q.s.
Water	14	oz.
Gum Arabic	10	,,
Glycerine	14	,,
Syrup	10	,,

PROCEDURE:—Bring the water to a boil, stir in the other ingredients. Mix well and strain through calico. In 10 oz. of this fluid dissolve 1 oz. of any soluble aniline dye:—For black, use nigrosine; for blue, blende lumiere; for green, methyl green; for red, eosin and *fuschine; for violet, methyl violet.*

V.

Red, Scarlet, or Violet Dye	2	dr.
Rectified Spirit	2	oz.

PROCEDURE:—Powder the dye and drop it into the prescribed amount of rectified spirit. *Cork the bottle and shake well to bring* about a thorough incorporation. Apply the ink in adequate quantity to the stamping pad before use.

Similar procedure may be followed in *preparing rubber stamping inks of other* colours. Only the proportion of the dyestuff need be suitably changed. To get, for example, blue rubber stamp inks, dissolve 1 dr. of methylene blue or acid blue in 2 ounces of *rectified spirit; for green inks* dissolve 4 dr. of green dye in 2 ounces of rectified spirit; and so on.

VI.

Fast Aniline Blue or Red, etc.	16	parts
Distilled Water	80	„
Glycerine	7	„
Syrup	3	„

PROCEDURE:—The colour is dissolved in hot water and the other ingredients are added with constant stirring.

This ink does not dry quickly upon the cushion but is nevertheless rapidly absorbed by the paper without blurring

VIOLET.

Aniline Violet	4	oz
Glycerine	2	pints
Gum Arabic Mucilage	2½	„
Water	2	„

PROCEDURE:—Dissolve the dye in the water, add the other ingredients and mix well together.

II.

Aniline Violet	8	oz
Glycerine	2½	lbs
Treacle	2	pints
Water	1	pint

PROCEDURE:—Proceed as before, adding treacle last

BLACK.

Aniline Black	1	part.
Alcohol	30	parts
Glycerine	30	„

PROCEDURE:—Mix and pour upon the cushion of the stamp and rub with a brush.

RED.

Carmine	4 oz.
Liquor Ammonia	12 „
Glycerine	2 „
Dextrine	12 „

PROCEDURE:—Dissolve the carmine in ammonia, then add the glycerine, and finally the dextrine.

II.

Magenta Aniline	4 oz.
Glycerine	3½ lbs.
Gum Arabic	3½ lbs.
Water	2 pints.

PROCEDURE:—Dissolve the magenta and gum each in 1 pint of water, add together and stir in the glycerine.

BRIGHT RED.

Eosine	4 oz.
Glycerine	4½ lbs.
Methylated Spirit	½ pint.
Water	½ pint.

PROCEDURE:—Dissolve the eosine in the water and stir in the glycerine and spirit. This will give a brilliant red.

BLUE.

Prussian Blue	1 lb.
Glycerine	4½ lbs.

Gum Arabic	4½ lbs
Water	2 pints

PROCEDURE —Dissolve the gum in the water, work in the blue, then add the glycerine

II

Blue Aniline	12 oz
Glycerine	8½ lbs
Wood Vinegar	2 pints
Methylated Spirit	2 ,,
Water	2 ,,

PROCEDURE —Dissolve the aniline in the water, add the other ingredients and mix well together

CHAPTER X.

METAL STAMPING INKS.

PRINCIPLE OF MANUFACTURE.

METAL stamping inks are also in large use among the traders and their preparation is very simple.

The principle involved in the making of metal stamping inks consists in macerating the dyestuff, preferably synthetic, in a mortar with just sufficient amount of glycerine or non-drying oil and then having the ingredients fully incorporated by slow heating after adding requisite amount of glycerine or oil to render the ink of the proper consistency and intensity. *Printing inks thinned down with* non-drying oils, like castor or olive oil, produce metal stamping inks. Recipes follow:—

BLUE.

Aniline Blue (oil soluble)	5	parts.
Oleic Acid	2	,,
Castor Oil	30-32	,,

PROCEDURE:—*Macerate the dye in oleic* acid and then add the oil little by little.

BLACK.

Aniline Black (oil soluble)	5	parts.
Oleic Acid	6	,,
Castor Oil	94	,,

PROCEDURE:—Macerate the dye (oil soluble) in oleic acid and then add the oil little by little with constant rubbing. After incorporating the whole of the oil heat the mixture, under constant stirring, to about 167°F

RED.

Bordeaux Red (oil soluble)	15	parts
Aniline Scarlet	15	,,
Crude Oleic Acid	50	,,
Castor Oil	950	,,

PROCEDURE:—Rub the dye (oil soluble) to perfect smoothness in oleic acid; then add the oil little by little, with constant rubbing. Finally heat the mixture with constant stirring

VIOLET, BLUE, GREEN, ETC.

Violet, Blue, Green or Red Aniline Dye (oil soluble)	1	dr.
Glycerine	1	oz.

PROCEDURE:—Mix thoroughly by maceration and slowly heat the ingredients together on a slow fire Then pack air-tight for use

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CHAPTER XI.

HECTOGRAPH INKS.

HECTOGRAPH inks are employed in writing the original, when copies of the written matter are to be made with a duplicator.

Violet inks are the most favoured. A few recipes follow:

VIOLET.

I.

Methyl Violet	1 oz.
Water	9 oz.
Acetic Acid	30 drops.

PROCEDURE:—The water is heated and acidulated with strong acetic acid. Finally the colour is dissolved into this when a good ink will be obtained.

II.

Methyl Violet	100 parts.
Acetic Acid	50 ,,
Spirit (Dilute 90 p.c.)	100 ,,
Distilled Water	100 ,,
Glycerine	50 ,,

PROCEDURE:—Dissolve the dye in the acetic acid and then add the other ingredients one by one.

III

Methyl Violet	*10*	*parts*
Alcohol	10	,,
Gum	10	,,
Water	70	,,

PROCEDURE —The ingredients are kept together for about two hours at 50° to 60°C, and then filtered hot through flannel

IV

Methyl Violet	10	parts
Barium Sulphate	30	,,
Liquid Paraffin	35	,,
Soft Paraffin	115	,,

PROCEDURE —Dissolve the methyl violet in hot methylated spirit, pour the solution on to barium sulphate and dry on a water bath Grind to fine powder, add the liquid paraffin and after thorough incorporation add the soft raffin

V

Methyl Violet	1	oz
Methylated Spirit	1	oz
Water	7	oz

PROCEDURE —The ink is suited for use in plicating pads

VI

Any shade of violet can be got by mixing ie and red inks in different proportions ecially serviceable in this connection are the ie inks made with water-soluble blue and : red ink already given

RED.

I.

Rosaniline	2	oz.
Alcohol	1	oz.
Water	10	oz.

PROCEDURE:—Red hectograph ink is made by dissolving the rosaniline in alcohol and diluting the product with hot water.

II.

Diamond Magenta	20	parts.
Alcohol	20	,,
Acetic Acid	5	,,
Gum	20	,,
Water	140	,,

PROCEDURE:—Same as in (I).

III.

Diamond Magenta	10	parts.
Alcohol	10	,,
Glycerine	10	,,
Water	50	,,

PROCEDURE:—These inks are prepared like those with methyl violet. The second recipe gives a very good ink.

IV.

Fuchsine	2	parts.
Meth. Spirit	2	,,
Acetic Acid	½	part.
Gum Acacia	2	parts.
Water	14	,,

PROCEDURE:—Proceed as above. The ink is suited for use in duplicating pads.

BLUE

Water-soluble Blue (Mainz Fabrik)	10	parts
Glycerine	10	,,
Water	50 100	,,

PROCEDURE —Mix with the aid of gentle heat The amount of water should be taken between the limits stated according to the number of copies required This ink will be found excellent for every requirement, and to copy the finest strokes perfectly

II

Blue Aniline	½	oz
Alcohol	1	oz
Glycerine	1	oz
Sugar	2	dr
Water	6	oz

PROCEDURE —Dissolve the aniline in the alcohol, add the other ingredients and warm together in a flask until solution is complete

GREEN.

Aniline Green D.	100	grs
Glacial Acetic Acid	5	drops
Glycerine	½	dr
Rectified Spirit	1	,,
Distilled Water	7	drs

PROCEDURE —Dissolve the dye in a mixture of the other ingredients by the aid of heat

II

Water-soluble Blue	10	parts
Picric Acid	10	,,

Spirit (90 per cent.)	30	parts.
Glycerine	10	„
Water	30	„

Different shades can be obtained by varying the amount of picric acid.

BLACK.

Aniline black or nigrosine is insoluble in water, and black hectograph inks are got by rubbing up a mixture of dark methyl violet and nigrosine with alcohol and glycerine.

I.

Methyl Violet	10	parts.
Nigrosine	20	„
Methylated Spirit	60	„
Glycerine	30	„
Gum Acacia	5	„

This ink is always very thick on account of the nigrosine in it being in the solid state. It is therefore little used.

VIOLET OR BLUE.

Aniline Violet or Blue	1	oz.
Spirits of Wine	1	„
Glycerine	¼	„
Carbolic Acid	1	drop.
Water	1	oz.

PROCEDURE:—Dissolve the violet or blue aniline in 7 oz. of hot water, cool, add the spirits of wine and glycerine and 1 drop of carbolic acid.

MIMEOGRAPH INK.

Borax	2	oz.
Shellac	2	„
Water	25	„
Gum Arabic	2	„

PROCEDURE:—Boil together borax, shellac and water until 25 oz is obtained Then add 1 oz gum arabic (finely powdered) with sufficient pigment to produce colour required For black ink use lamp black with dash of blue, for blue ink, Prussian blue or indigo, for red ink, Venetian red—all in fine powder.

CYCLOSTYLE INK.

Aniline Blue	2	parts
Rectified Spirit		q. s.
Glycerine	1	part

PROCEDURE:—Grind the aniline colour with the glycerine and then add sufficient quantity of spirit to make it a thin paste. Lastly add a few drops of oil of cloves to impart a pleasant odour, if it is desired

II.

Grind aniline colour with glycerine, thinning with spirit, if desired. A few drops of oil of cloves will give a pleasant odour, if it is wished

HECTOGRAPH OR COPYING PAD.

Gelatine or glue, 3 oz.; glycerine, 15 oz.; barium sulphate or kaolin (finely powdered), ¾ oz ; water 11 oz.; oil of cloves, 40 drops.

Soak the gelatine overnight in cold water, then pour off the excess of water, warm the gelatine in a double-walled kettle, add the glycerine and barium sulphate and mix thoroughly, pour in the tin dish and cool; avoid bubbles.

The above composition is suitable for a tin dish, 7″ × 11″ in sizes; but for bigger sizes the proportions of all the ingredients would be increased to get the desired effect.

Direction for use:—Moisten the pad slightly with a sponge and dry with a blotter. With a new steel pen write on writing paper with hectograph ink and dry. Place this face downward on the pad; rub gently all over the back to insure perfect contact. After a minute remove and take your copies one after another with hand pressure or a rubber roller. When peeling off copies, grasp a corner immediately after each job, wash the surface of the pad lightly with a sponge and cold water, sometimes with a little hydrochloric acid added to the water. If the surface becomes uneven, remelt in and cool. If too sticky, add a little gelatine in remelting. In warm weather use less glycerine.

CHAPTER XII

STENCIL INKS.

STENCIL inks are largely in use in marking bales, boxes, packages, etc and for re producing any writing, mark or design on wall, wood, etc. several times with the help of stencils A few well-tried recipes follow —

RED

Shellac	2	oz
Borax	2	,,
Water	25	,,
Gum Arabic	2	,,
Venetian Red		q s

PROCEDURE:—The borax and shellac are put in some water and boiled till they are dissolved The gum arabic is then added and the fire is withdrawn. When the solution cools down, the rest of water is poured in and a sufficient quantity of the red is added to bring the whole to the proper consistency

BLUE

Shellac	4	parts
Borax	1	part
Prussian Blue		q s

PROCEDURE:—To obtain blue stencil inks, get 4 parts of shellac and 1 of borax, and dis-

solve in some boiling water. Bring the whole to a thin syrupy consistency by dilution with hot water. Finally add to the lac solution soluble Prussian blue in proportions as desired. Soluble blue carmine can also be used in place of the Prussian blue.

Red stencil ink may be obtained by proceeding in the same manner and adding in place of the blue pigment a sufficient quantity of Brazil wood extract or some soluble coal-tar red.

II.

Shellac	2	parts.
Borax	2	,,
Water	25	,,
Ultramarine		q. s.

PROCEDURE:—The shellac and borax are first boiled with water. The solution is then mixed with a suitable proportion of ultramarine to give the desired colour.

BLACK.

I.

Shellac	2	parts.
Borax	2	,,
Water	25	,,
Lampblack or Nigrosine		q. s.

PROCEDURE:—Boil the shellac and borax on water and then incorporate a sufficient quantity of lampblack or nigrosine to give the desired colour.

II

Lampblack	1	oz
Fine Clay		q s
Gum Arabic		q s
Vinegar		q s

PROCEDURE —Mix the first three ingredients together The lampblack furnishes the colour, fine clay gives a body and gum arabic serves as an adhesive Water is added to serve as a solvent A few drops of vinegar will facilitate the admixture Gum arabic may also be replaced by cheaper substances such as dextrine or gum tragacanth

This stencil ink may be used with good results on boxes and packing cases where permanency of the markings is a factor to be attained

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CHAPTER XIII.

MARKING INKS.

THE marking inks are used for making distinctive marks on garments in order that they may not be lost. These should be able to resist repeated washing and bleaching.

Marking ink of a black colour may be obtained by treating with alkali or lime water the juice of the Indian tree *Anacardium Orientale*. Juice of aloes, cashewnut, etc., is also employed for the purpose. Marking inks are generally black, but those of fanciful colours mostly prepared from silver nitrate are now in great demand. These inks are mostly prepared from silver nitrate and are put in orange or blue-bottles to keep away light as far as possible. A few recipes follow:—

RED.

I.

Nitrate of Silver	24	parts.
Tartaric Acid	30	„
Gum	20	„
Carmine	1	part.
Ammonia		q. s.
Water	40	parts.

PROCEDURE:—Triturate the silver salt and tartaric acid in a perfectly dry state and

then add the red carmine, previously dissolved in a small quantity of ammonia, just sufficient to dissolve it Finally add the gum and water

II

Nitrate of Silver	24	parts
Tartaric Acid	30	„
Gum	20	„
Carmine	1	part
Water	40	parts

PROCEDURE·—Rub the nitrate of silver and tartaric acid together in a perfectly dry state and then add the ammonia to them, using no more than will give perfect solution with diligent stirring The clear solution is mixed with the gum in solution and diluted, if necessary with water.

III

Eosine	2	drams
Mercuric Chloride (Solution)	2	„
Mucilage of Acacia	4	„
Rectified Spirit	8	ounces
Oil of Lavender	3	drops
Distilled Water	16	ounces

PROCEDURE:—Dissolve the eosine in the solution of mercuric chloride and 4 ounces of water; add the mucilage and mix Then dissolve the oil in spirit and afterwards make up the whole.

IV.

Beat fresh egg albumen with an equal weight of water and filter through calico

Mix the filtrate with sufficient finely powdered vermilion to make a thin cream. Write with a quill, and then apply a hot flat iron to the back of the material, when the albumen will be fixed and the ink rendered indelible.

V.

Mix 3 parts of pale gum-lac, 1 part of liquid ammonia, and 6 to 8 parts of water. Keep in a well-corked bottle for 12 hours, then boil in an earthen vessel, stirring constantly till the gum is dissolved. Now dissolve in it some aniline yellow, and then add an ammoniacal solution of carmine.

BLUE.

Silver Nitrate	1 dr.
Ammonia (Sp. Gr. 0.884)	3 ,,
Sodium Carbonate Crystallised	1 ,,
Gum Arabic	1½ ,,
Copper Sulphate	30 gr.
Distilled Water	4 dr.

PROCEDURE:—Dissolve first the nitrate in liquor ammonia. Next in a separate vessel have the next three ingredients dissolved in distilled water.

The two solutions are to be mixed before application.

II.

Rosorcin Blue	1 dr.
Distilled Water	q. s.

Oxalic Acid	10 gr
Sugar	½ oz

PROCEDURE:—The colour is first dissolved in 6 dr of distilled water Agitate occasionally for 2 hours, then add 24 oz of hot distilled water and prescribed quantities of oxalic acid and sugar.

III

Silver Nitrate	25 parts
Gum	15 ,,
Ammonia	60 ,,
Indigo	q s

PROCEDURE:—Dissolve the first two in ammonia and add indigo Write with a quill pen and fix by passing a hot iron over it

IV

Distilled Water	32 fl oz
Liquid Ammonia	24 ,,
Copper Sulphate	2¼ lbs
Gum Arabic (Powder)	¾ ,,
Silver Nitrate (Powder)	½ lb
Sodium Carbonate	½ ,,

PROCEDURE:—Dissolve the nitrate of silver in ammonia; the sulphate of copper, gum, and soda in distilled water Then mix and strain

GREEN.

Silver Nitrate	4 dr.
Water	3 oz
Ammonia	q s
Sap Green	q s

PROCEDURE:—The nitrate is dissolved in the water and then strong ammonia is added gradually until the precipitate which first forms is redissolved. A little sap green is added for colour. A hot iron is to be pressed on the marks for fixing.

ORANGE.

Aniline Orange	1 part.
Sugar	2 parts.
Distilled Water	64 "

PROCEDURE:—Dissolve the colour in the distilled water and add the sugar.

BLACK.

I.

Nitrate of Silver	2 oz.
Soda Carbonate	3 oz.
Water	10 oz.
Tartaric Acid	¾ oz.
Litmus	½ oz.
Gum	4 oz.

PROCEDURE:—The nitrate of silver is first dissolved in 4 oz. of water and the carbonate of soda is dissolved in another lot of 6 oz. of water. Add the soda solution to the silver solution so long as a white precipitate is formed. Filter and wash the precipitate with distilled water and rub it in a mortar with some water and tartaric acid. Now add ammonia cautiously until the precipitate is redissolved. Finally add litmus or water

soluble blue and the gum in solution Dilute, if necessary

II

Borax	6	parts
Shellac	18	,,
Boiling Water	100	,,
Lampblack		q s

PROCEDURE —Dissolve the borax in the water, and the shellac to the solution and stir until dissolved Rub up a little lampblack with sufficient of the liquid to form a paste and add the rest of the solution a little at a time and with constant stirring To get the best effect, a pure jet black, the lampblack should be purified from calcium phosphate by treating it with hydrochloric acid and washing with water

III

Pyrogallic Acid	1	oz
Sulphate of Iron	1	oz

PROCEDURE —Mix pyrogallic acid and sulphate of iron in equal parts This is particularly useful for marking labels on bottles containing acid

IV

Silver Nitrate	25	parts
Gum Arabic	15	,
Ammonia Sol	60	
Lampblack or Indigo	2	,

PROCEDURE —Dissolve the nitrate in ammonia Rub up lampblack or indigo in the mucilage of gum arabic Finally mix

V.

Aniline Black	2	parts.
Alcohol 95 p.c.	40	"
Hydrochloric Acid	2	"
Shellac	3	"

PROCEDURE:—Add first three to shellac, dissolved in 150 parts strong alcohol.

CLOTH STAMPING INKS.

Cloth stamping inks are prepared in various ways, of which the inks made with mineral colours and an oily basis are generally used. A few recipes are given below:—

BLUE.

Ultramarine	5	parts.
Linseed Oil or Olive Oil	8	"

PROCEDURE:—Reduce the ultramarine to an impalpable powder, and mix with the linseed oil.

GREEN.

Verdigris	6	parts.
Oleic Acid	1	part.
Olive Oil	8	parts.

PROCEDURE:—Rub the verdigris to very fine powder, mix the oleic acid with it, and, after a few minutes, the olive oil.

RED.

Vermilion	8	parts.
Linseed Oil	1	part.
Olive Oil	4	*parts.*

PROCEDURE:—Prepare as above All these inks should be well shaken before pouring on the pad

MARKING INK PENCILS

Marking ink pencils are in demand, but are not quite satisfactory To prepare it, take silver nitrate 2 parts, clay 7 parts, and black lead or other colour 1 part Mix the ingredients together and then press in moulds to the shape of pencils When these are used the fabric is first damped with water, the writing is then done, and the article is ironed

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CHAPTER XIV.

PRINTING INK.

AT present there is a large demand for good and at the same time cheap printing inks. The swadeshi movement has given an impetus to Indian industries in general and printing ink industry in particular. There are very few Indian firms manufacturing really good printing ink. So Indian capitalists should come forward to start new factories to meet the present demand.

The preparation of printing inks, as would appear at first glance, does not consist merely in the combining together of pigments, driers and vehicles in certain proportions; but requires careful manipulation, for the presence of *the smallest body in it, even if it is* only a minute lump of pigment is sufficient to cause a stain in printing. Besides the mere combination of ingredients, the quality, suitability and characteristics of these materials must be considered in order to arrive at the combination that will be both chemically and physically adapted to give the best results.

PROPERTIES OF GOOD INK.

A good printing ink should be durable, bright and deep in colour. It must not dry

too slowly nor too rapidly. Its consistence must be such as to prevent its penetrating so deep into the paper as to blur the appearance of printing on the other side. It must not affect the soft elastic rollers which are employed to convey it to the types When the printing is dry the ink should not form fatty edges round the types. It should be glossy and absolutely free from granular appearance

A SIMPLE TEST.

A good quality ink should leave only a short thread suspended when a small portion is extracted from the mass.

Its consistence is indicated by the adhesion upon pressing the finger on a quantity of it

GENERAL CONSIDERATIONS FOR PRODUCING GOOD PRINTING INKS.

There are four general essentials for producing good printing inks

First, the material should be properly proportioned, that is, the pigments should be carefully weighed out so as to make the colour desired directly, without additions, and this can generally be done if a formula is worked up in a small way in a laboratory. The vehicles should always be carefully weighed with the error on the side of stiffness rather than softness, as it is easier to make a stiff ink soft than to stiffen up a soft ink, as the latter requires the addition of dry pigment and

this is very troublesome, especially if the colour is a mixture of two or more pigments. In this case there will always be some difficulty in matching the colour. It might be noted here that many colours which seem stiff when mixed will be a great deal softer after running through the mills. Hence, in these cases experience is the only way to get rid of these difficulties.

Secondly, the materials must be thoroughly mixed, every particle of pigment be brought into contact with the varnish and the whole mass wetted out so that it has a uniform consistency.

Thirdly, the ink should be sufficiently ground to make its mass homogeneous and perfectly smooth. Some inks therefore from the nature of the pigment used and the kind of work the ink is intended for require more grinding than others.

Fourthly, all inks, after coming from the mills should be blended; that is remixed, so that the colour will be uniform. This is particularly necessary in inks that are made from two or more pigments and for pigments that have any tendency to work away from the oil. Corrections in the hue or consistency of the inks should be made at the time of blending. For the purpose of correcting the hue a set of stock inks consisting of the various pigments ground in oil or varnish should be

kept beforehand The addition of these will bring the ink to the proper hue and consistency at the same time and obviate the necessity of regrinding the batch, which would be necessary if the dry pigments were added

RAW MATERIALS

The only suitable material for the preparation of good printing ink is linseed oil of the best quality Resin and soap are sometimes used as addition for special purposes Of these the linseed oil and resin form the adhesive material, while soap is said to cause the ink to adhere uniformly to the face of the type, to coat it completely with the smallest quantity, to leave the face of the type readily and easily attach itself to the paper, to wash readily from the type, and to prevent (in a measure) the formation of a skin on the ink An excess of soap tends to give a bad "distribution" and consequently uneven impression, and hinders drying so that the ink "sets off" when printed sheets are pressed

Cheap printing inks for newspaper use, etc, are manufactured by substituting cheaper substances such as, resin oils, resin, paraffin oil, coal tar oil, turpentine, soap, etc instead of thick boiled linseed oil

Lampblack forms the colouring matter of the ordinary black printing ink

Before employing, purify the linseed oil by digesting it with dilute sulphuric acid for some hours at 212°F Allow the impurities to

subside and remove the acid by repeatedly washing with hot water. It will then be of a pale lemon colour and entirely free from smell. It is then cautiously boiled according to the nature and quality of the ink to be manufactured.

For elegant printing the oil should be boiled down more and thus the ink will be costlier. For quick printing (e.g. newspapers), a more fluid ink is used than for printing books.

BOILING LINSEED OIL.

THIN BOILED LINSEED OIL.

Place the oil in a boiler of sufficient capacity so that the vapour of boiled oil may not come in contact with the flame. Light up the fire and raise the temperature to 420°F. Now for every 80 gallons of oil, add gently 1 lb. of magnesia, draw fire, and allow to cool down. Now pass through fine muslin in order to free it from all particles of fat or grit in the oil. After straining transfer the oil into finishing boiler and gently raise the temperature taking care not to agitate the oil in any way. When the temperature is up to about 200°F, skim off the scum as quickly as it forms and skim that rises on the oil, and raise up heat to 520°F. Keep at that for 10 hours. Then draw fire and strain once more into settling tank. This will now be a paler and brighter tint than at the beginning. The

greatest attention must be paid to clearing the oil from the dark skim that arises, otherwise it will discolour the whole batch and cause bad results

MIDDLE BOILED LINSEED OIL

The process for this is exactly the same as for thin, but boiling is carried out at 530°F for three days Maintain the heat constant throughout the whole period

STRONG BOILED LINSEED OIL

Same as above but boil for quite 6 days, 10 hours a day

The original character of the oil is totally altered by this process of boiling At first it becomes turbid but becomes clear when allowed to repose It is thin, viscid and adhesive, leaves no grease stain upon paper penetrating it with difficulty and dries much more rapidly When combined with colouring matters it shows no yellow, fatty borders

PREPARATION OF VARNISH

Varnish for printing inks is usually manufactured in several strengths according to the nature of inks to be prepared The basis of all these varnishes is boiled linseed oil which does not leave a grease stain upon the paper It is generally necessary to prepare two kinds of varnish varying in consistence from more or less boiling, to be occasionally mixed together as circumstances may require,

that which answers well in hot weather being too thick in cold and vice versa. Large characters also require a thinner ink than small ones. Old linseed oil is preferable to new.

To prepare varnish the oil is boiled in the manner as previously stated and allowed to clear for a short time. Reduce the resin to small pieces and melt in a pot over a moderate fire. When perfectly fluid add resin soap cut up in small pieces. When this is dissolved add the boiled linseed oil. Stir the whole thoroughly, allow to stand upon the fire for half an hour until quite thin, and then filter through fine linen to separate admixed impurities of the resin. Then allow the oil to repose in the hot state so that the impurities may deposit on the bottom. Decant or draw off after a few days.

PROPORTION OF VARNISHES.

Several proportions of varnish are indicated below:—

I.

	Parts by weight.		
	Weak	Medium.	Strong.
Resin	25	25	25
Boiled linseed oil	100	100	100
Resin soap	3	3	3
Linseed oil (partly boiled)	7	4	—

II.

	Parts by weight.		
	Weak	Medium	Strong
Resin	25	25	25
Boiled linseed oil	50	50	50
Resin soap	5	5	5
Linseed oil (partly boiled)	4½	5	—

III.

	Parts by weight.		
	Weak	Medium	Strong.
Resin	25	50	25
Resin oil	50	50	50
Boiled linseed oil	50	50	50
Resin soap	3	5	3
Linseed oil (partly boiled)	7	6	—

Copaiba and Venice turpentine are sometimes used in the making of varnish for the finer kinds of printing ink.

PREPARATION.

Now to prepare a good black printing ink a desired quantity of lamp black and varnish, which serves as base, is weighed out and then ground By this an intimate combination of the two ingredients take place; the method, of course, requires a considerable amount of

judgment and care. The machinery employed for the grinding of printing inks is simple but effective. Three adjustable rollers of granite with convenient scrapers attached constitute the main principles of mechanical grinding. In smaller works, however, this operation is accomplished by manual labour on a stone with a muller.

A few useful recipes follow:—

BLACK PRINTING INK.

I.

Put 6 quarts of raw linseed oil into an iron pan of 4 or 5 gallon capacity and heat until the escaping vapour will just ignite. Remove the heat and allow the vapour to burn until a drop of the oil when cooled can be drawn out into strings half an inch; extinguish the flame by placing the cover on the pot and stir until frothing has ceased. Then gradually add 6 lb. of resin, and when that has dissolved add 1¾ lbs. of dry soap in fine shavings, stirring well after each addition. Lastly, replace on the fire and bring to a boil. This constitutes the varnish to which any desired colour may be imparted by grinding suitable pigment into it by means of a paint mill or a slab and muller. Now for black printing ink add the ingredients mentioned below one by one:—

Prussian blue 5 oz.; Mineral Lampblack 4 lbs.; Ordinary lampblack 3½ lbs.

II

Balsam of copaiba	9	oz
Lampblack	3	„
Indigo or Prussian blue	1¼	„
Indian red	¾	„
Turpentine soap, dry	3	„

Grind the ingredients to impalpable fineness and then incorporate with sufficient quantity of varnish prepared as on page 137 This is said to be an excellent ink

III

Balsam copaiba	36	oz
Lamp black	12	„
Paris blue	5	„
Indian red	3	„
Resin soap	12	

Proceed as above

For coloured inks use white soap instead of resin soap

IV

Balsam of copaiba (pure)	9	oz
Lampblack	3	„
Indigo	½	„
Prussian blue	½	„
Indian red	¾	„
Yellow soap	3	
Varnish		q s

Grind the mixture to an impalpable smoothness by means of a stone and muller or a grinding machine and then incorporate with

the varnish to produce sufficiently thick ink. Canada balsam may be substituted for balsam of copaiba where the smell of the latter is objectionable, but the ink then dries very quickly.

This is said to be an excellent ink for giving good effect to highly finished wood engravings.

V.

Paraffin	25 lbs.
Colophony	25 ..
Lampblack	15 ..
Yellow Soap	½ lb

Mix colophony and soap over fire, then remove and add the paraffin and lampblack and grind through colour while warm.

COLOURED PRINTING INKS.

Coloured printing inks are made in a similar way from the following pigments: Carmine, lakes, vermilion, chrome yellow, red lead, orange red, Indian red, Venitian red, for red; orange chrome. chrome yellow, yellow ochre, for orange and yellow; verdigris, Scheele's green, Schweinfurt green, blue and yellows mixed, for green; indigo. Prussian blue, cobalt blue, for blue; bronze powders. etc. for metallic colours: and sepia, for brown.

RED INK.

I.

Linseed oil	8 pints.
Resin	4 lbs.

Dry brown soap	2	lbs
Vermilion or chrome red		q s

Boil oil till smoke arises, then apply a lighted taper fastened on the end of a stick, remove the pot from the fire, and allow the oil to burn until it can be drawn into strings about half an inch long, now add the resin and the soap, the latter cautiously, as it causes a violent ebullition Then grind the mixture with the pigment either on a stone with a muller or in a suitable paint mill

II

Balsam of copaiba	12	oz
Dry yellow soap	3	,,
Vermillion or chrome red		q s
Varnish		q s

Warm the mixture and grind it to an impalpable powder on a stone or in a suitable mill Lastly, incorporate with sufficient quantity of varnish

III

Middle boiled linseed oil	60	lbs
Hydrate of alumina	10	,
Paris white	14	
Vermilion	94	,

Proceed as before

BLUE

Blue varnish	58	lbs
Middle boiled	14	,,

Ultramarine blue	72	lbs.
Paris white	7	„

First of all prepare the blue varnish by boiling for 2 hours:

Raw linseed oil previously heated	100	gals.
Rosin	20	„
Soap	1	lb.

Now add the other ingredients and grind to an impalpable powder on a stone or in a suitable brinding mill.

GREEN.

Green colour may be produced by suitable admixture of yellow with blue. Thus when mixed with yellow chromate of lead Prussian blue gives a good rich green; similarly yellow chromate of lead mixed with indigo gives a deeper, duller colour and this mixed with Antwerp blue gives a brilliant rich green. To ensure good colours the chromate must be quite pure.

YELLOW.

Chromate of lead yields the highest yellow. It works freely and well and is readily ground into a fine ink.

Yellow ochre gives a useful colour which is dull but pertinent. It is also easily ground into a fine ink.

CHAPTER XV.

MISCELLANEOUS INKS.

AUTOGRAPHIC INK FOR LITHOGRAPHERS.

WHITE soap 25 parts, white wax 25 parts; mutton suet, 6 parts, lampblack, 6 parts, shellac, 10 parts, mastic, 10 parts Mix with heat and proceed according to the mode of manufacturing lithographic ink

II

White wax 8 parts; white soap 2½ parts; lampblack 1 part; shellac 2 parts Melt first two, incorporate the lampblack, heat strongly and mix in shellac. Heat again

CARBON INK.

Genuine India Ink is rubbed down with good black ink until it will flow easily from a pen This ink resists chlorine and oxalic acid

DRAWING INK.

A very black and indelible drawing ink can be made by dissolving shellac in hot solution of borax in water and rubbing up in this solution a fine quality of India ink After using, dip the drawing pen in alcohol and wipe dry to keep it clean and bright The ink is also waterproof

GOLD INK.

1. Take honey and gold leaf equal parts; triturate in a mortar until the gold is reduced to the finest possible state of subdivision. Finally agitate with hot water, and allow it to settle. Decant the water and repeat the washing several times. Finally dry the gold and mix it with a little weak gum water for use.

2. Gold leaf mixed with honey is ground fine, washed, dried and suspended in gum arabic and 1 part of potassium silicate dissolved in 4 parts of water. Gold leaf may be substituted by Dutch leaf or bronze powder.

SILVER INK.

Use aluminium foil as in preceding.

GOLD AND SILVER INKS.

Gold and silver inks are generally made by triturating the powdered metal (or suitable alloy thereof, such as Dutch metal for gold, and silver bronze with zinc oxide for silver) with water made sufficiently viscous with acacia mucilage or sodium silicate.

GOLD INK FOR VELLUM.

Grind gold leaf or bronze leaf with gum water and add a little bichloride of mercury.

HORTICULTURAL INK.

Verdigris and sal ammoniac, each ½ oz.; levigated lampblack ½ oz.; common vinegar

¼ pint; mix thoroughly Use with a clean quill to write on zinc, iron or steel labels

INDESTRUCTIBLE INK

Ten parts of good caustic potash dissolved in boiling water, 4 parts of comminuted leather-waste and 2 parts of flowers of sulphur are boiled to dryness in a cast iron ves sel The dry substance is then heated, with constant stirring, until it becomes soft, care being taken to prevent it from igniting Sufficient water is gradually and carefully added until the liquid assumes a very dark colour, which is strained through a cloth and kept in well-closed bottles Writing on paper executed with this ink is not affected by concentrated caustic lye nor by concentrated nitric acid

INDESTRUCTIBLE INK FOR DOCUMENTS ETC.

Mix 1 part of honey, 14 of water, 2 of sulphuric acid, and enough indigo, dissolved in fuming sulphuric acid, that the fluid seems to be sufficiently coloured to furnish legible writing on paper The writing executed with this ink, which, of course, must not be done with a steel pen, becomes perfectly black by heating the paper To prevent the writing from being destroyed by free acids, it is mois tened with spirit of sal-ammoniac after the paper has been heated, or the document is placed in a box and there subjected to the action of vapours of carbonate of ammonia

It is claimed that this ink answers all demands.

INDESTRUCTIBLE STAMPING INK.

Dilute 1 part of coal-tar with 1 of benzine, and stir into it 1/10 part of lampblack. Mix into a homogeneous paste which is used for stamping. By adding more or less benzine it can be given any consistency desired. This is used for stamping cotton and woollen goods which are to be bleached with chlorine.

INDIA INK.

Lampblack is ground to a paste with weak solution of caustic potash and this paste is then diffused through water, slightly made alkaline with caustic potash. Then it is collected, washed in clean water and dried. The dry powder is next levigated to a smooth stiff paste with a strong filtered decoction of quince seeds. A few drops of essence of musk and about half as much essence of ambergris are added by way of perfumes towards the end of the process. The mass is lastly moulded into cakes which are ornamented with devices as they are dry and hard.

INDORSING INKS.

Dissolve 1 part of aniline blue, violet or magenta, according to the colour required, in a mixture of 30 parts of alcohol and 30 parts of glycerine.

INK CAKE.

Extract 42 parts of Aleppo gallnuts and 3 of madder with sufficient water; then filter the fluid and dissolve in it 5 2 parts of sulphate of iron and compound it with 2 parts of solution of methyl acetate of iron and 1.2 parts of solution of indigo Evaporate this mixture to dryness at a moderate heat and form into cakes of desired size. One part of this ink dissolved in 6 of hot water gives an excellent writing and copying ink, while a beautiful ordinary writing ink is obtained by dissolving 1 part in 10 to 15 parts of water.

INK FOR CANCELLING POSTAGE STAMPS

Lampblack, 1 av.oz.; gum arabic, 164 gr ; glycerine, 2 fl. dr., water, 80 minims. Dissolve the gum in the water, add glycerine to the mucilage formed and then filter Finally triturate the lampblack with the filtrate until a uniform product is obtained .

INKS FOR WRITING ON CELLULOID.

1. Ferric chloride, 10 parts; tannin, 15 parts; acetone, 100 parts Dissolve the ferric chloride in a portion of the acetone, and the tannin in the residue, and mix the two solutions Any pen may be used with the liquid

2 Pale drying varnish, 2 oz.; best quality black printing ink, 8 oz.; aniline blue, soluble in oil, ½ oz. Other colours may be

made by mixing the oil-soluble anilines with pale drying varnish.

INK FOR WRITING ON ENAMEL.

Use vegetable black, mixed with a hard-drying varnish and thinned with boiled linseed oil and turpentine.

INK FOR GLASS OR PORCELAIN.

Dissolve 10 parts of bleached shellac and 5 parts of Venetian turpentine in 15 parts of oil of turpentine. Immerse the containing vessel in warm water. After the solution is effected, 5 parts of lampblack are added.

INK FOR WRITING ON GLASS.

Shellac 20 parts; alcohol 150 parts; borax 35 parts; water 250 parts; water-soluble dye sufficient to colour. Dissolve the shellac in the alcohol and the borax in water. Now pour the shellac solution slowly into that of the borax. Then add the colouring matter previously dissolved in a little water.

II.

Rub together equal parts of lamp-black and iron scales with strong gum mucilage. The ink so obtained can be used for writing on glass.

INK FOR LEATHER.

Make a pretty strong decoction of logwood, preferably in soft water by boiling, then

add green vitriol at the rate of 2 oz. to the gallon and ½ oz. each of bichromate of potash and gum arabic. The last three ingredients and sometimes the logwood are powdered; instead of logwood chips extract of logwood may be used at the rate of 1 oz to a gallon of water.

INK FOR MARKING ON GLASS AND METAL LABELS.

Dissolve with the aid of heat 15 parts of finely sifted copal in 120 parts of oil of lavender; then rub up with this solution 2 parts of thoroughly calcined lampblack and keep the mixture in a well-closed bottle Before using the ink shake it thoroughly, and if too thick reduce it with some oil of lavender or rectified oil of turpentine It is not acted upon by acids.

For Red Ink use cinnabar instead of lampblack and prepare the marking ink according to the following proportions One part of copal, 8 parts of oil of lavender. and 3½ parts of cinnabar.

INK FOR MARKING SACKS

Dissolve 6 lbs. of rosin and 40 oz. of shellac in smallest quantity of methylated spirit Keep this in a mortar and mix 5 lbs of lampblack thoroughly with them Then add some more spirit and bottle In all about 10 pints of methylated spirit will be required

INK PAPER.

Take aniline, any colour, 1 oz.; hot water, ½ pt.; alcohol, 2 oz. Put the aniline and alcohol in a pint bottle and shake several times, then add the water and shake till the aniline is dissolved. Pour out into a shallow vessel and soak pieces of white blotting paper in the ink solution till they become saturated. Hang them up to dry, then cut into pieces 2½ by 5 inches, and put six pieces in an envelope. To make the ink put one piece into a bottle with ½ pint of water and shake several times, when the ink is ready for use.

INK FOR STONE OR MARBLE.

Take asphaltum and oil of turpentine, equal parts. This is used in a melted state for filling in letters engraved on tombstones, marble slabs and monuments, and is very durable.

INK FOR WRITING ON TIN.

1. Nitric acid, 12½ parts; copper, 1¼ parts; added water, 12½ parts. Clean the tin with dry whiting; write with a quill.

2. Mix verdigris, 1 part; sal-ammoniac, 1 part; chimney black, ½ part; water, 10 parts. To be well shaken in a bottle (and labelled poison). To be used with a quill pen.

INK FOR TRAVELLERS.

Saturate white blotting paper with a strong solution of one of the aniline dyes.

black, navy blue, scarlet or violet, a little gum should be put in the solutions While still wet, press three or four sheets together to form a pad, then dry A small square cut off and put in a little water makes ink in a few minutes A good plan is to use a punch, say one used for cutting gum wads, which makes a clean, round wafer These may be put up in boxes

INK FOR TYPEWRITER RIBBONS

The inks used for typewriter ribbons are made from basic dyes rubbed down to a fine paste with oil and this is used for impregnating the ribbons Glycerine may also be used in place of mineral oil using 5 lbs of dyestuff rubbed up with 25 lbs of glycerine and then dissolving by heating to 195°F Should any dyestuff separate during cooling a little water is added and the mixture heated again The following dyes are mostly used: Carbon Black, Jet Black, Methylene Yellow, Induline B, Bismarck Brown, Bordeaux Red

Although glycerine figures in many of the recipes for ribbon inks, owing to its non-drying qualities, it is not considered so perfect a vehicle as it might be. A better substance is vaseline technically known as petrolatum Melt some of this on a water-bath, and rub into it while hot as much pure lampblack as it will take without becoming so dry as to be granular When partly cool, gradually dis-

solve the whole in a mixture of equal parts of petroleum, benzine, and turpentine oil. The finished mixture should be of the consistency of fresh oil paint. *To test the ribbon, try one* end. If the ink is too thin, add some wax; if *too hard, add vaseline; if insufficiently dark,* add a little lampblack. Put it freely on the ribbon, then brush off the excess.

TYPEWRITER PAD INK.

Dissolve 1 part of aniline black (oil solution) in 6 or 8 parts of oil of cloves, by gentle heat. Apply, while warm to the pad with a camel-hair brush. Before applying the ink see that the pad is not over-worn.

JAPAN INK.

Dissolve in $\frac{1}{2}$ pt. of soft water $\frac{3}{8}$ oz. of potassium bichromate, and add the solution to 6 oz. of logwood extract, dissolved in 1 gal. of water; then dissolve in 1 gal. of water by continued boiling, borax, 6 oz. and shellac, $1\frac{1}{2}$ oz. Mix all together while warm, and add 3 oz. of ammonia.

LITHOGRAPHIC INKS.

Take mastic in tears, 8 oz.; shellac, 12 oz.; Venice turpentine, 1 oz. Melt together, add wax 1 lb.; tallow 6 oz. When dissolved, further add hard tallow soap, in shavings, 6 oz. and when the whole is combined add lampblack 4 oz. Mix well, cool a little, and then pour

it into moulds or on a slab and when cold cut into square pieces

LUMINOUS INK.

Phosphorous, half drachm oil cinnamon, half ounce, mix in phial, cork tightly, heat it slowly until mixed A letter written with this ink can only be read in a dark room

RULING INK

GREEN FAINT —Vinegar 8 gallons, verdigris 2 lbs , sap green ¼ lb Steadily boil the verdigris in the vinegar for about 1 hour, stir in sap green and strain well

BLUE FAINT —1 Water 10 gallons, acetic acid ¾ gallon, gum arabic 4 lbs , neutral blue 10 oz Boil the gum in the water until completely dissolved, add acetic acid and stir in the neutral blue while hot Then strain off

2 Distilled water 15 gallons, Chinese blue 2 lbs , Oxalic Acid ¾ lb Cover the blue and acid with three quarters of a gallon of the water (boiling) and leave for a day to dissolve Then finish off by diluting with the remaining water, which must be boiling or quite hot, as cold water sometimes causes the blue to precipitate

BLUE.—To get faint lines dissolve in a small quantity of hot water 20 parts of Prussian blue by the aid of 3 parts of potassium ferrocyanide and dilute the solution with thin

gum water until the proper degree of colour is obtained.

RED.—To 1 gallon of simmering vinegar add 1 lb. of Brazil wood and let them simmer together for half an hour; then add ¾ lb. of alum to set the colour. After a few days add ¼ pint of fresh gall to 1 quart of red ink.

SCHOOL BOARD INK (BLACK).

Naphthol black aniline 2 oz.; water 1 gallon. Dissolve the aniline in the water (cold) and it is ready for use.

SYMPATHETIC INKS.

A *sympathetic ink is one that is invisible* when written but which can be made visible by some treatment. Use the following substances *for writing and then heat: the writings will* come out:—(1) Cobalt chloride; (2) Cobalt acetate and a little saltpetre; (3) Nitric acid; (4) Sodium chloride; (5) Copper *sulphate* and ammonium chloride. Writings with the following may be brought out by exposure to sun light:—(1) Silver nitrate (2) *Gold trichloride.*

The following inks are developed by exposure to the action of reagents.

1. Write with dilute nitrate of *silver* which when dry will be entirely invisible: hold the paper over a vessel containing sulphate of ammonia and the writing *will* appear very

distinct The letters will shine with the metallic brilliancy of silver

2 Write with a weak solution of sulphate of iron, let it dry and it will be invisible By dipping a feather in the tincture of galls and drawing the wet feather over the letters, the writing will be restored and appear black

To write coloured letters with colourless inks, the paper is treated suitably and then written upon with chemicals

BLUE LETTERS—Prepare a paper by moistening with a solution of oxalic acid and drying A diluted solution of cobalt nitrate is used for writing

RED LETTERS—Prepare the paper with a weak solution of sulphate of iron to which a little nitric acid has been added then write with a dilute solution of sulphocyanide of potassium

YELLOW LETTERS—Prepare the paper with acetate of lead and write with bichromate of potash

ORANGE LETTERS—Prepare the paper with a solution of yellow protochromate of potash and write with the extractum Saturni

PURPLE LETTERS—Prepare the paper with chloride of tin and write with a solution of chloride of gold

VANADIUM INK

Dissolve 45 gr of tannin in 7 fl dr of water and 2 gr of ammonium vanadate in 1

fl. dr. of water and mix the two solutions. A deep black colour is developed which is however unaffected by water.

WATERPROOF INK.

Boil 8 oz. shellac in a solution of borax made by dissolving 2 oz. of borax in 72 oz. of water: then strain. Grind colours with this such as vermilion, indigo, etc. For small quantities the colour may be rubbed in a mortar. These inks can be used for drawing. For transparent colours use aniline dyes.

WHITE INK.

For use on coloured paper, take zinc white, 2 drs.; white precipitate 5 drs.; mucilage of acacia, 1 dr.; water 6 drs. Triturate the zinc white and the precipitate with 2 drams of water until perfectly smooth; then add the mucilage and the rest of the water. The ink requires shaking from time to time to prevent the pigments from settling to a solid mass at the bottom.

GLOSSARY.

ACACIA—A species of tree, the gum and bark of which are used in ink making. Vernacular equivalents are babla, babul, gu-kikar, nagatumma The gum yielded by this tree is called gum acacia.

ALIZARINE—The colouring principle of Indian madder (manjit, manjistha) now prepared synthetically.

ALUM—A double sulphate of aluminium and potassium, commonly known as phitkari, phatkiri, sphatikari, shib, zak

ANILINE DYES—Dyestuffs obtained from benzene, which is a most-valued bye-product during the destructive distillation of coal They are so called because they are derived from aniline which is chemically known as aminobenzene or phenylamine

ANNATTO—Seed of Bixa orellano, used for the orange red dye Commonly known as roucou, latkan, jarat, kisri.

BELLERIC MYROBALAN—Bhaira, bahera, sagona, lupung, yella, tani, elupav, santi.

BLUE VITRIOL—Copper sulphate, which see

BORAX—Sohaga, tinkal, annabedi, tankankhar, venkaram, lakhiya, sodium tetraborate

BRAZIL WOOD—Sappan wood, bakam, sappanga

CARMINE—Colouring principle of cochineal.
CASTOR—Arand, bherenda, eri, rendi, gaba, grundi, harnauli, ind.
CATECHU—Khair, katha, cutch.
CHALK—Khari-matti, kharya-mitti.
CHROME ALUM—Otherwise known as potassium chromium alum and is a double sulphate of potassium and chromium.
CINNABAR—Hingul, sulphide of mercury.
COCHINEAL—Female insects of Coccus giving a red dye; kirdana, kirmaz, kiranda, kirm.
COPPER SULPHATE—Blue vitriol, tuntia, mortutta, mayil tuttam, turichu.
COPPERAS—Ferrous sulphate, which see.
CREAM OF TARTAR—*Potassium hydrogen tartrate.*
CREOSOTE—This is obtained from coal-tar and forms the basis of many disinfectants.
EMBELLIC MYROBALAN—Amlaki, daula, gondhona, bhoza amali, tappi, saljee, etc.
FERROUS SULPHATE—Sulphate of iron, copperas, hirakash, green vitriol.
GALLNUT—Majuphal, Aleppo or Chinese galls.
GLUCOSE—A sugar found in *many* of the sweet fruits. Obtained by the action of sulphuric acid on potato starch.
GRAPE SUGAR—Same as Glucose, which see.
GREEN VITRIOL—See Ferrous sulphate.
GUM ARABIC—Arabi gund.
INDIGO—Nila.
INDIGO CARMINE—Sulpho-indigotic acid, see *page* 24.

JACK WOOD—Kanthal, panasa phala, kan taka
KAMELA DYE—Kamela powder, kambila, sin dhuri, punag, tung, gangai, puroa, kapli
LAC—Lakha, gala
LAMPBLACK—A finely divided carbonaceous deposit resulting from imperfect combustion of natural gas and lamp and other oils and fatty substances Impure carbon
LODHWOOD—Khoidai, singen, palyok, hura, luddliga, kaviang, bhimreti
LOGWOOD—Chips of logwood come from Central America
MADDER—Manjet, manjista majethi
MASTIC—Rumi mastiki, kundur rumi, arah
MUCILAGE—Water into which gum is dis solved
MYROBALAN—Harra, har, haritaki, hilika, silim, rola, kadakai, panga, etc
OLIVE—Jalpai
PARIS BLUE—Basic ferrocyanide
QUINCE—Cydonia vulgaris bihi
RECTIFIED SPIRIT—Redistilled alcohol, sp gr 0 82
ROCK CANDY—Sugar candy, misri
SAL-AMMONIAC—Ammonium chloride
SHELLAC—Lakha, gala
SMALL TAURI—Tari, teri, tourhi
SODIUM CARBONATE—Carbonate of soda, ordinary soda or soda crystals
SOLUBLE GLASS—Sodium silicate, silicate of soda

SPIRIT OF WINE—Commercial alcohol, sp. gr. 0.83.

SUET—Hard and less fusible tallow, fat (charbi) of cattle and sheep.

SULPHATE OF IRON—Same as Ferrous Sulphate, which see.

TALC—Steatite, soapstone, abrak, sikhari, appractum, sang-i-palaun, bulpum.

TANNIN—Chemical constituent of myrobalans, gallnuts, etc.

VERDIGRIS—Green coloured basic copper acetate, zangar.

VERMILION—Sindur, red mercuric oxide.

VINEGAR—Sirka, 4 % acetic acid solution.

WATER GLASS—Aqueous solution of sodium silicate.

WOOD SPIRIT—Methyl alcohol.

WEIGHTS AND MEASURES.

1 seer (sr.) = 16 chhataks (ch.) = 2.057 lb.
1 pound (lb.) = 16 ounces (oz.) = 7.778 ch.
1 ounce (oz.) = 16 drams (dr.)
60 minims (drops) = 1 dram = $\frac{1}{8}$ fluid ounce (fl. oz.).
1 quart = 2 pints = 40 fl. oz. = $\frac{1}{4}$ gallon.
1 bottle = 24 fl. oz.

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